HYDRO-ELECTRIC

POWER

How Water is Turned into Power

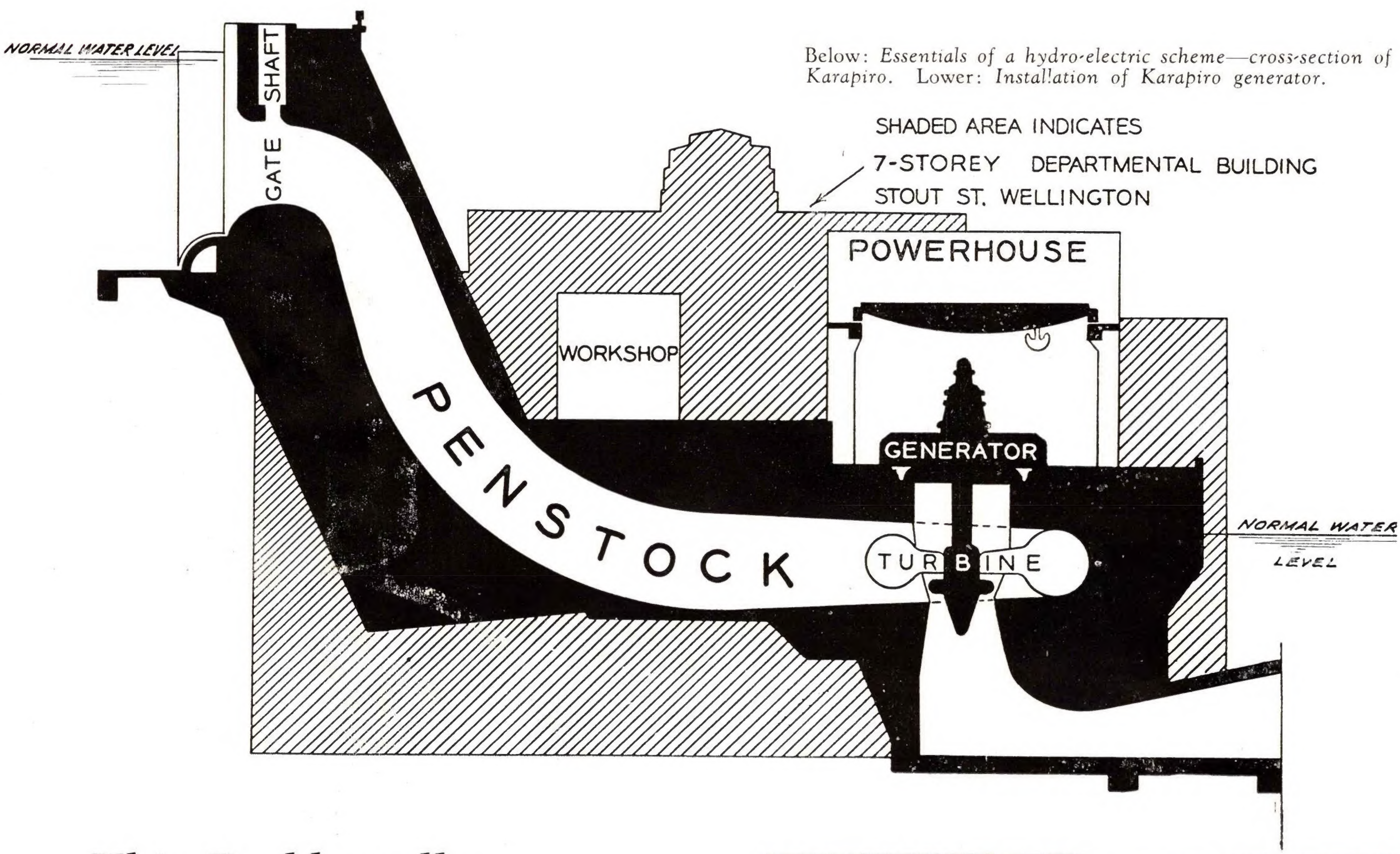
IN simple terms, a hydro-electric power unit comprises a water turbine and an electric generator. The turbine converts the force of falling water into mechanical power, which drives the generator. The greater the quantity and pressure of water, the greater the power available.

The most common method of harnessing water-power is to dam a river at a suitable place, and lead the water down to a power-house through great steel tubes called penstocks. The cross-section diagram of Karapiro, below, shows how these tubes may penetrate the dam itself.

Where an adequate fall for the water cannot be obtained at the dam site, the power-house must be built at a lower level, frequently some distance from the dam. This means the installation of big pipe-lines to carry the water from the storage lake to the generators. This has been done at Coleridge, in the South Island, and at Waikaremoana in the North. It is a method also used with artificial storage areas, such as at Cobb, near Takaka.

The vertical fall, measured in feet, is known technically as the "static head" of water. Tuai, at Lake Waikaremoana, for instance, has a static head of 676 feet. Cobb has the highest—1,876 feet; Arnold, the lowest, has 42 feet.

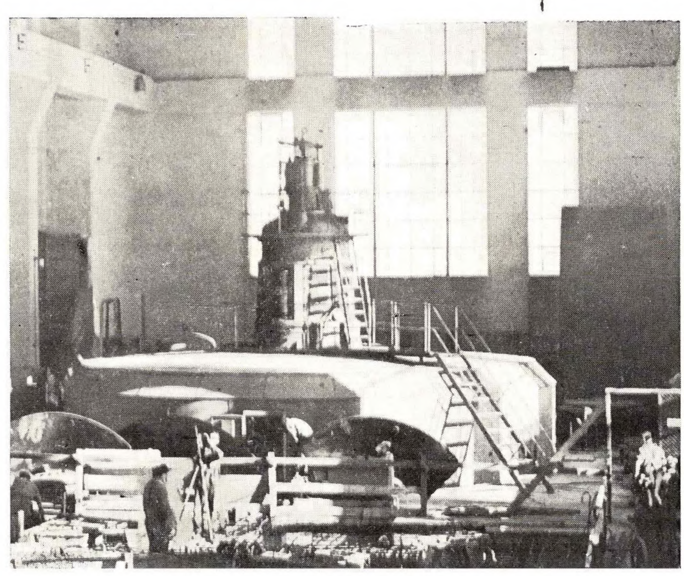
Below: *Essentials of a hydro-electric scheme—cross-section of Karapiro.* Lower: *Installation of Karapiro generator.*



This Booklet tells–

in brief, the story of hydro-electric power in New Zealand, from the days when water was first harnessed on the goldfields. It follows the birth and growth of a vast enterprise of State through peace and war; surveys to-day's problems and achievements, and looks ahead to to-morrow's bold, imaginative projects.

It is not a technical booklet. It is an attempt to tell, in simple terms, what New Zealand owes to electricity; how virtually all that electricity must come from water-power; how the demand for more power continues to grow—and what is being done to satisfy that demand.



The Need for Power

HIGHLY developed for its size and age, New Zealand, with limited coal deposits and practically no oil, is dependent, more than most other countries, on a plentiful supply of hydro-electric power. It is vital in the home, on the farm, in the factory, down the mine—anywhere, in fact, where light, heat and power are needed readily, cheaply and continuously.

The all-electric home is already standard for many housewives, with electric lighting, cooking, water-heating, and electrically operated vacuum-cleaners, washing-machines, refrigerators, toasters and radios. Almost every house has electric lighting at least; two homes in five cook by electricity, and rare is the house without a radio set. Domestic consumption is 56 per cent of the total power sold; domestic consumers number 435,294 out of a total of 511,699.

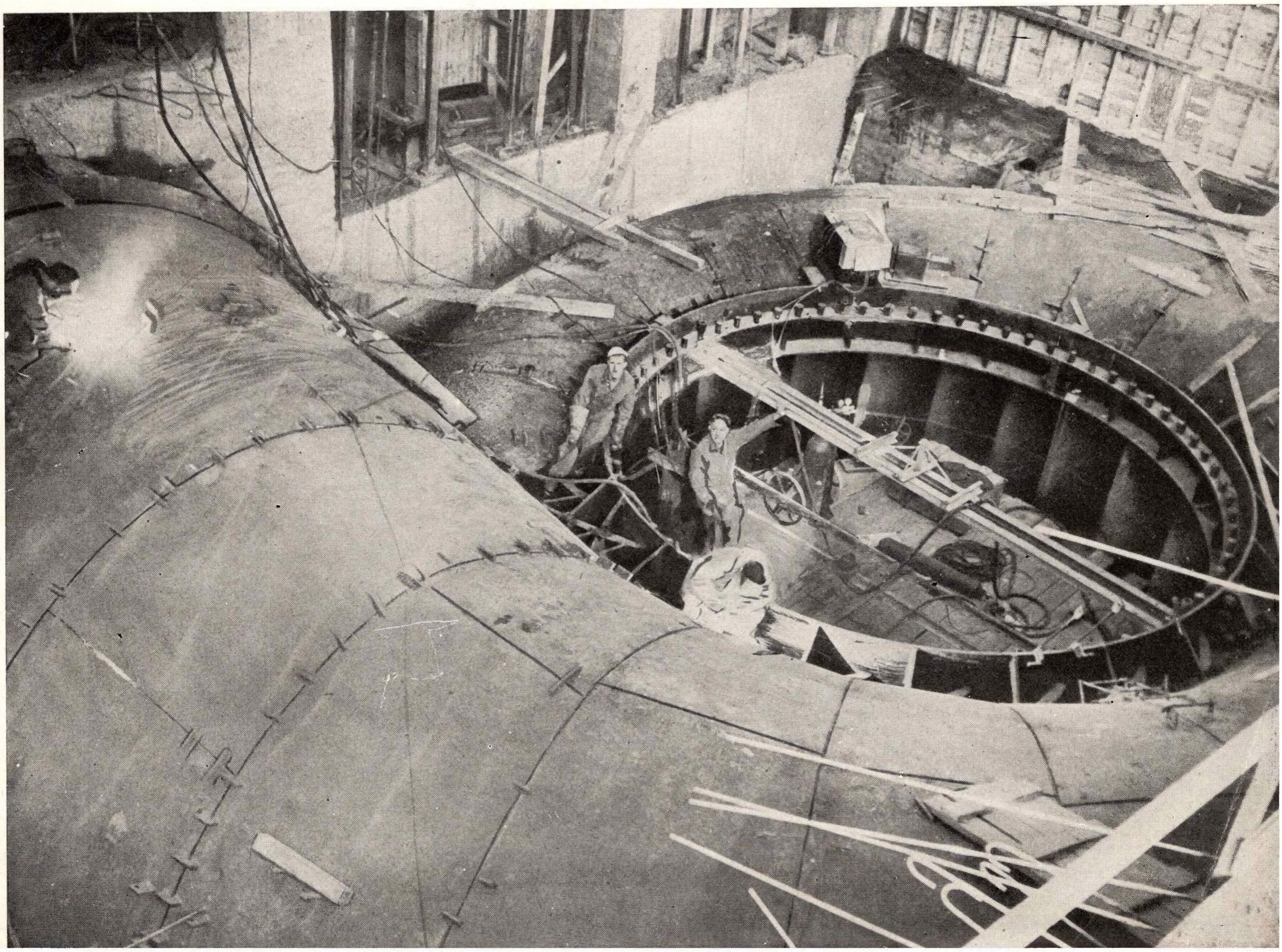
More and more farmers are using electric power. From 1925 to 1948 electrically driven milking-machines increased tenfold—from 3,581 to 35,687. Through the Rural Electrical Reticulation Council, a generous subsidy scheme, and the power supply authorities, the Government is supplying the primary producer, and others living in sparsely populated areas with electric power as widely and as quickly as possible.

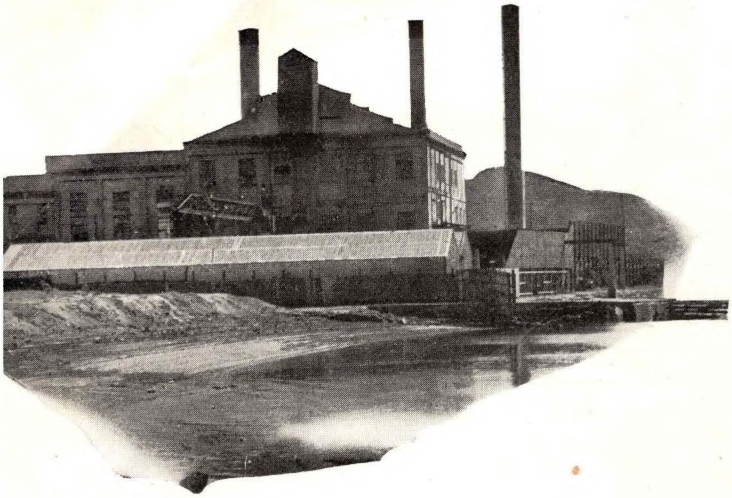
New Zealand's expanding secondary industries, too, are using more and more electricity. In 1947 there were 62,836 electric motors in factories—almost a threefold increase in ten years.

The country's transport services also need more power. Apart from the tramway systems of many of the larger towns, there is a far-reaching plan for the progressive electrification of railways. Already sections of the main lines have been electrified—notably Wellington-Paekakariki, Christchurch-Lyttelton, and the Otira Tunnel, through the Southern Alps. The next step will be the electrification of the suburban systems of Wellington and Auckland, and eventually the main trunk lines.

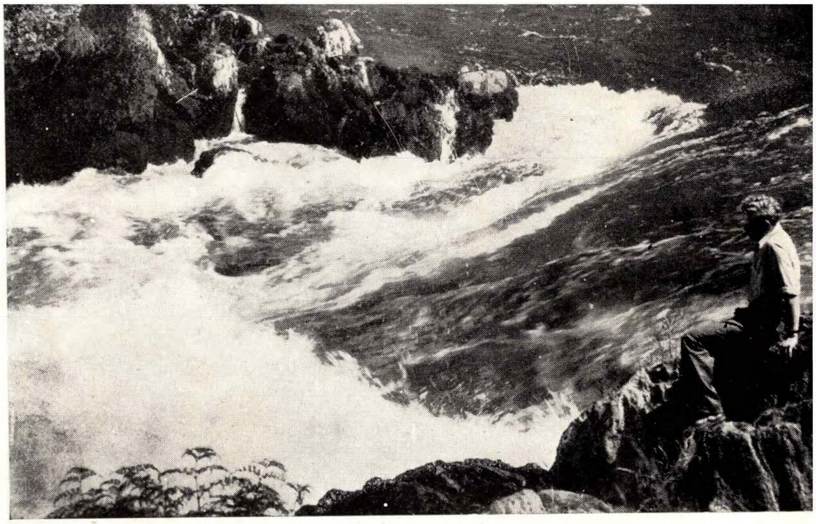
New Zealand's whole economy—apart from the domestic side—is rapidly becoming more electrified; and 95 per cent of the electricity is generated by water power. No less than 93 per cent of this power from water is generated by the State Hydro-electric Department.

Where the water is fed to the turbine—one of Karapiro's spiral casings being installed.





Wellington City Council's fuel station, Evans Bay.



The Waikato's power is equivalent to more coal than has ever been produced in any year in New Zealand.

Water is the Answer

MOUNTAINOUS New Zealand is generously provided with water resources for the generation of electric power. She is endowed with great lakes—especially in the South—natural storage reservoirs for hydro-electric schemes; and her rivers, though not comparable with some of the great water-courses of other lands, are numerous, and—above all—most of them have a steep fall to the sea.

Water power means much cheaper generation. The price of power from a hydro-electric station is fixed principally by the capital cost; but a fuel station involves about the same capital cost, plus a high cost for fuel, be it oil or coal. This results in the cost per unit produced from fuel being many times the cost of the unit generated by water-power. So, in an era of ever-expanding demand, New Zealand must look to her great water resources for an adequate, cheap and reliable supply of power. The average price of electricity to retail consumers for all purposes is, generally speaking, lower in New Zealand than anywhere else in the world.

One of the Clutha's sources—Lake Wanaka, Otago.

EARLY DAYS

HYDRO-ELECTRIC generation in New Zealand was pioneered on the goldfields. The first recorded use of hydro-electric power was in 1885, on the banks of the Shotover River, near Queenstown. Otago. The Phoenix Quartz Mining Company installed a 75-kilowatt Pelton Wheel plant, driving two brush dynamos, and transmitted electrical energy over two miles for lighting and power.

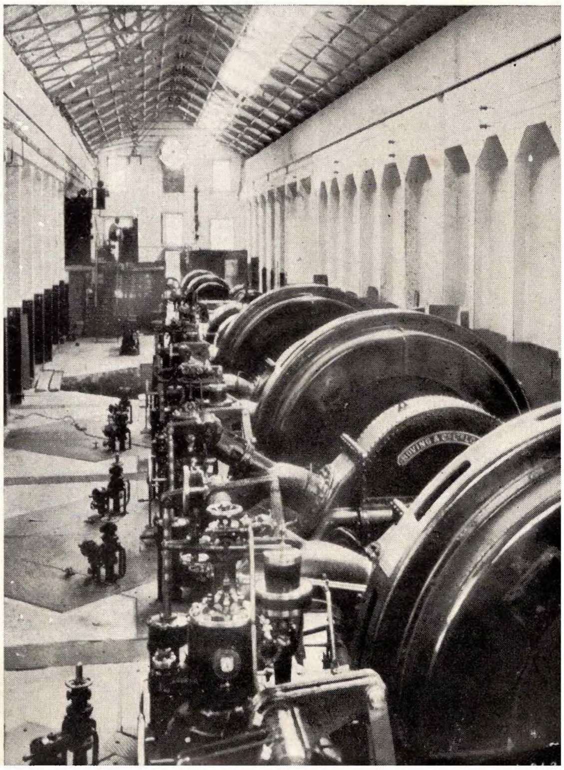
In 1887 the Reefton Electric Lighting Company installed a hydro-electric plant to use water from the Inangahua River. This is claimed to have been the first public electric supply system in the Southern Hemisphere.

Wellington about 1900.

Shotover River—gold and power.

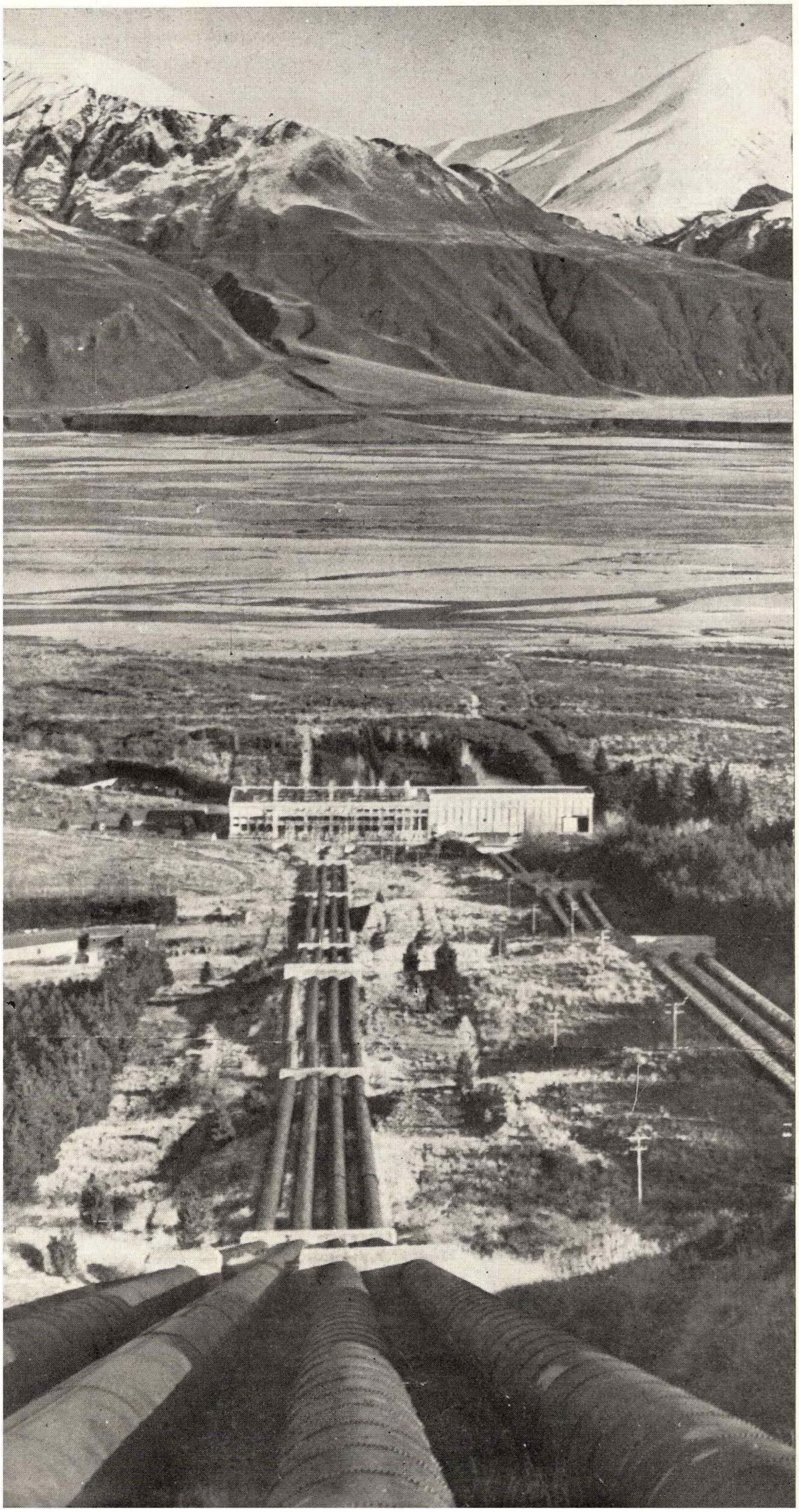
Wellington was the first city in the Southern Hemisphere to introduce electric street lighting . This was in 1888—when two stations, each with two 22-kilowatt "Vortex" turbines, were erected in the heart of the city; the turbines were powered by water from the city mains. In 1893 there was a change over to steam generation. Stratford in 1898, Patea and Rotorua in 1901, and Hawera in 1902 followed Wellington in the public supply of electricity. Next were Palmerston North, Christchurch, Bluff, Dunedin and Auckland.

Dunedin's 24,000-kilowatt station, Waipori, authorised 1904, operating since 1907.



The State's Role

FORTY-FIVE years ago the whole of the country's water-power rights were vested in the Crown. But it was not until six years later—in 1910—that the State came into the picture as a generator of electricity. In that year the passing of the Aid to Waterpower Works Act authorised the Government to raise £500,000 for electrical works. The following year the Lake Coleridge scheme was selected for development, to supply Christchurch city—63 miles away—and Canterbury province. In 1919 the State took the first step towards a national power system in the North Island. It acquired the Waihi Gold Mining Company's 6,300-kilowatt plant at Horahora on the Waikato River, and in 1925—when the construction of Arapuni began—Horahora's capacity was increased to 10,300 kilowatts. In 1922 the State commenced the Mangahao Scheme, near Wellington.



Under later legislation—notably under the Public Works Act (1928), the Municipal Corporations Act (1920), the Electric Power Boards Act (consolidated in 1925) and the Electricity Act (1945)—local authorities may be empowered to use water power and to sell the electricity so generated. Except in Southland, where the State has been the supply authority since 1936, all electric power for general use is retailed by local authorities. Of these 42 are electric power boards, 38 are ordinary local bodies such as city and borough councils.

Until 1945 the Public Works Department—now the Ministry of Works—was the State authority responsible for everything connected with the generation and wholesale distribution of electricity. In that year a separate State Hydro-Electric Department was set up to operate all State generating installations, and administer all the relevant legislation. The Ministry of Works still undertakes all new civil construction and design.

To-day the State is for all practical purposes the principal generating authority of hydro-electric power in New Zealand. National control has obvious advantages. It means a reliable supply from the network of interconnected stations; it permits the best use of available water storage, and it avoids unnecessary duplication of plant and staff, with a minimum overall cost.

The State Hydro-Electric Department's capital outlay now stands at £46,300,000. When its planned developments are completed, it should be the most highly capitalised trading department in New Zealand. The Department's revenue, which totalled £3,258,000 in 1947-48, allows it normally to stand on its own feet, paying interest, sinking fund on loan moneys, full depreciation and income tax.

Coleridge's seven units produce 34,500 kilowatts; pipelines are 2,700 feet long; static head, 496 feet.

Photo: Green & Hahn.

WAR AND DROUGHT

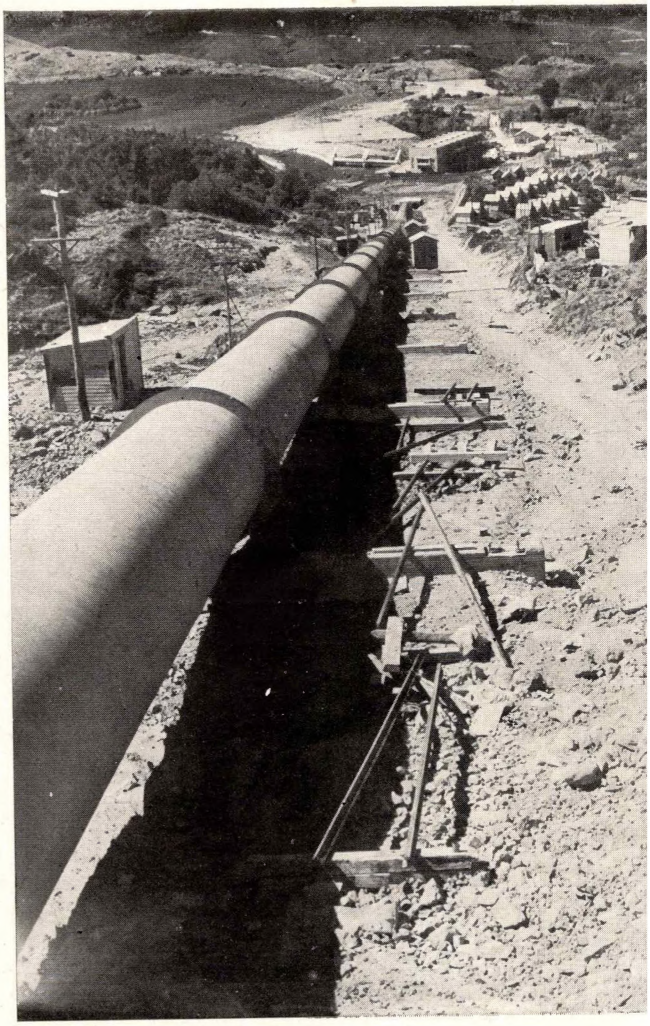
THE problems of electricity supply are being vigorously and successfully attacked, in spite of the aggravation of war-time and post-war difficulties. Such problems are by no means common to New Zealand. Australia, Canada, the United States, and even neutral, lake-scattered Sweden are finding it hard to catch up with the demand for power.

Pre-war prosperity caused unprecedented increases in demand, and the measures taken to cope with this expansion were largely nullified by the urgency of war industries and military requirements. In addition, the war disorganised deliveries of urgently needed plant and equipment from overseas, and made a heavy drain on available labour.

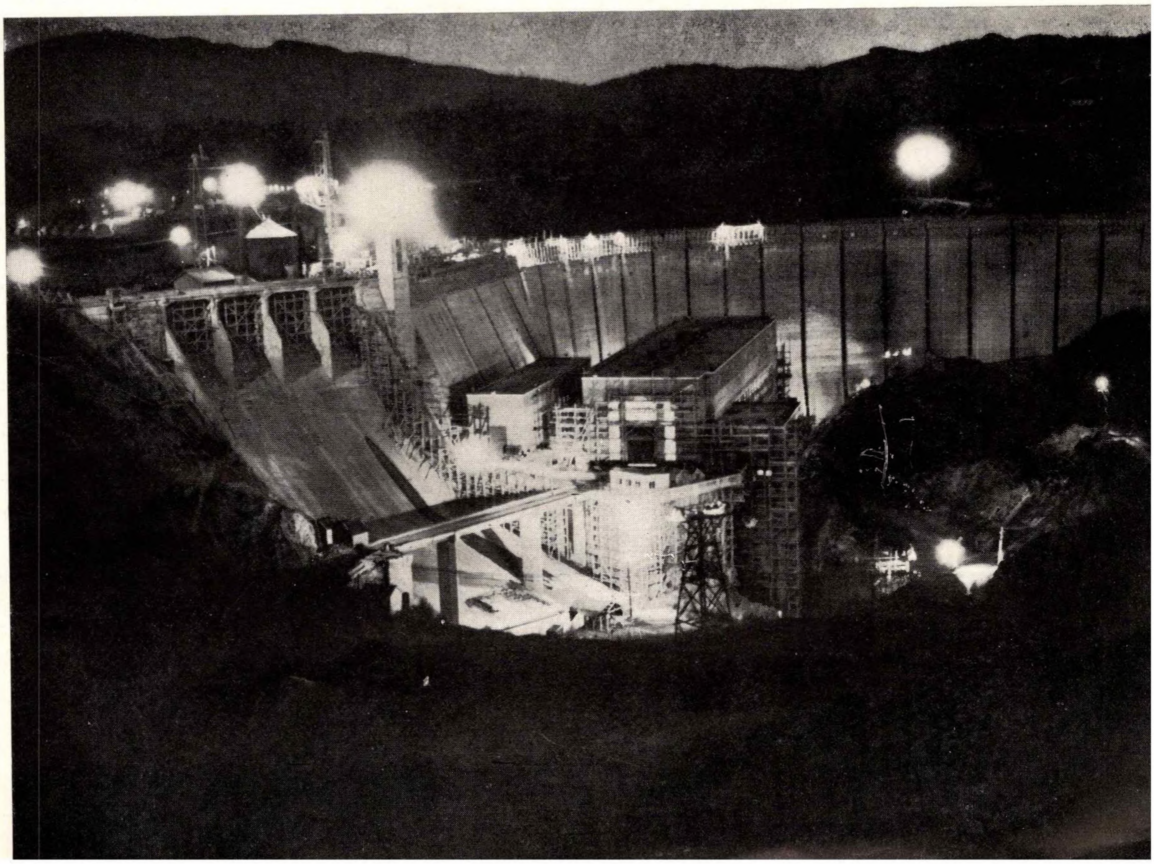
When war broke out four water-wheels were being made in Belgium and Sweden for Piripaua and Arapuni. The occupation of Norway cut off the delivery of two water-wheels from Sweden. The steamer *Devon* was sunk by torpedoes when bringing vital British parts for Waikaremoana. Although British workers toiled under bombs and black-outs to supply us with hydro-electric equipment, Piripaua's generators could not be delivered before 1943; final parts for Arapuni were held up till 1945.

With demand outstripping supply, power had to be conserved for essential needs. Added to all this, the immediate post-war years brought unusual droughts. Such dry seasons must be provided against in any supply scheme, but these droughts came at a particularly vulnerable time.

In spite of war, and allied problems, however, construction went on day and night, and supply was increased in the face of almost insuperable difficulties. That spirit still inspires the builders of New Zealand's hydro-electric schemes.



Kaitawa was mainly a war-time job.

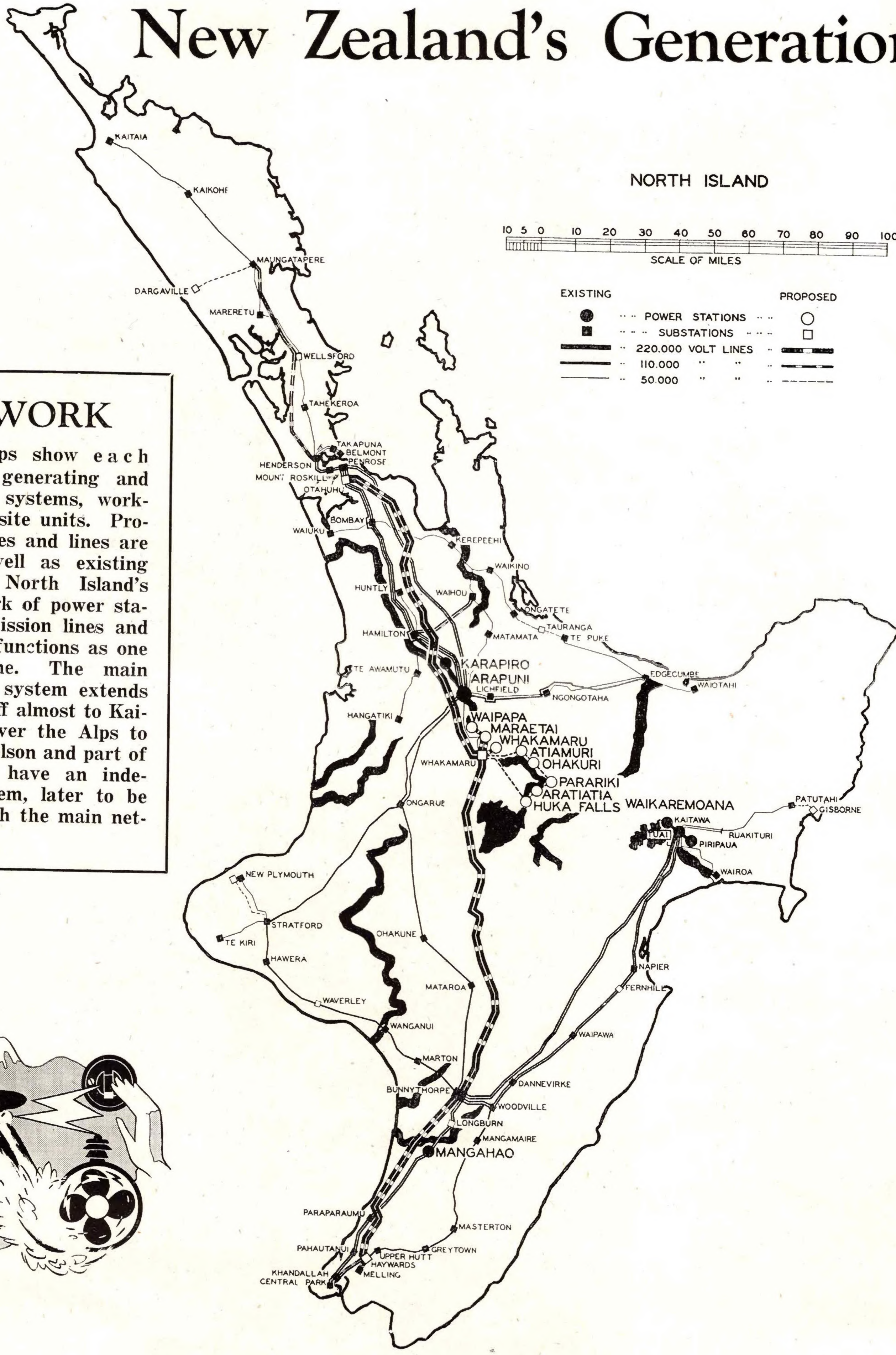


In spite of war — they worked day and night on Karapiro.

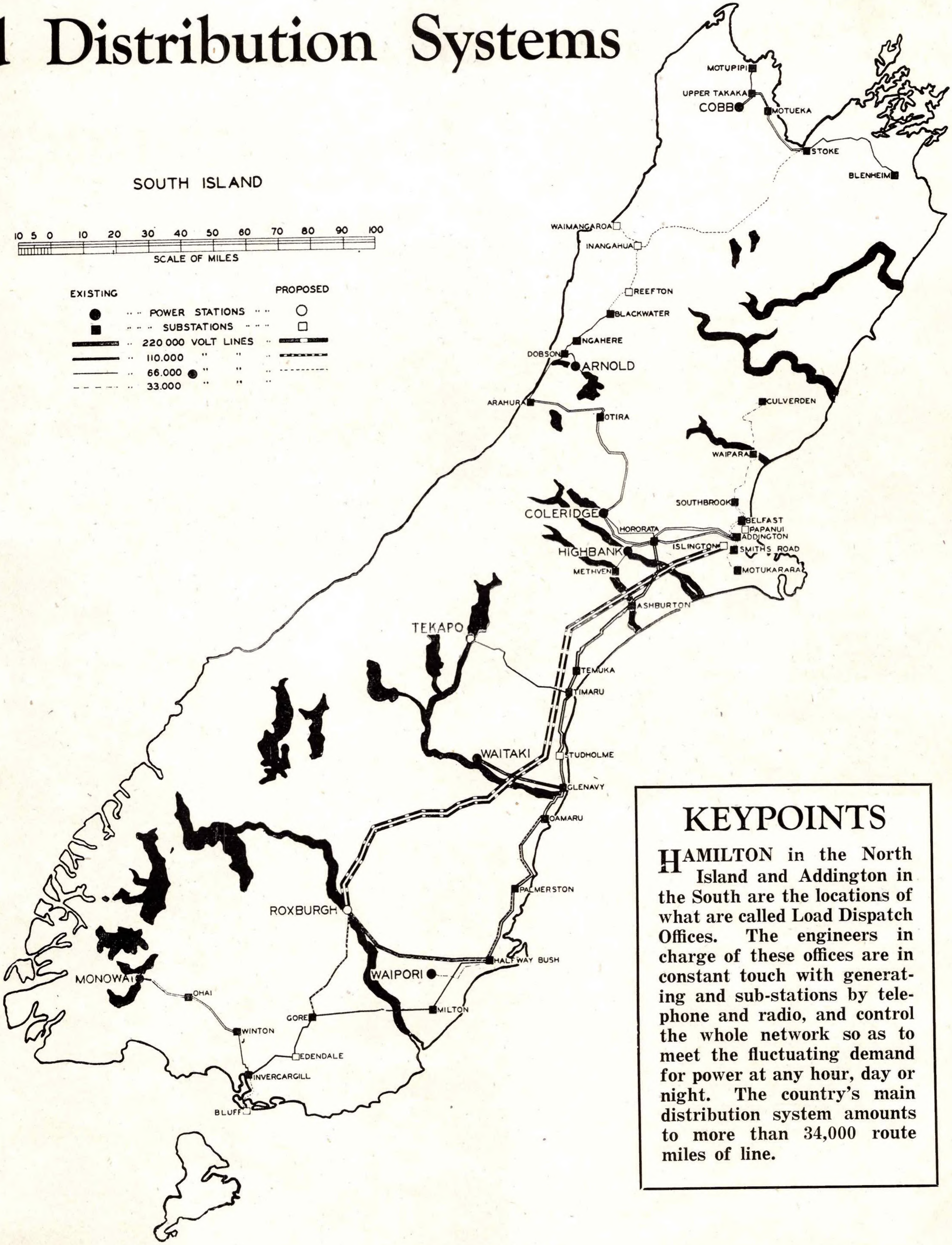
New Zealand's Generation

NETWORK

THESE maps show each island's generating and transmitting systems, working as composite units. Projected schemes and lines are shown, as well as existing ones. The North Island's entire network of power stations, transmission lines and sub-stations functions as one huge machine. The main South Island system extends from the Bluff almost to Kaikoura, and over the Alps to Westland; Nelson and part of Marlborough have an independent system, later to be linked up with the main network.



and Distribution Systems

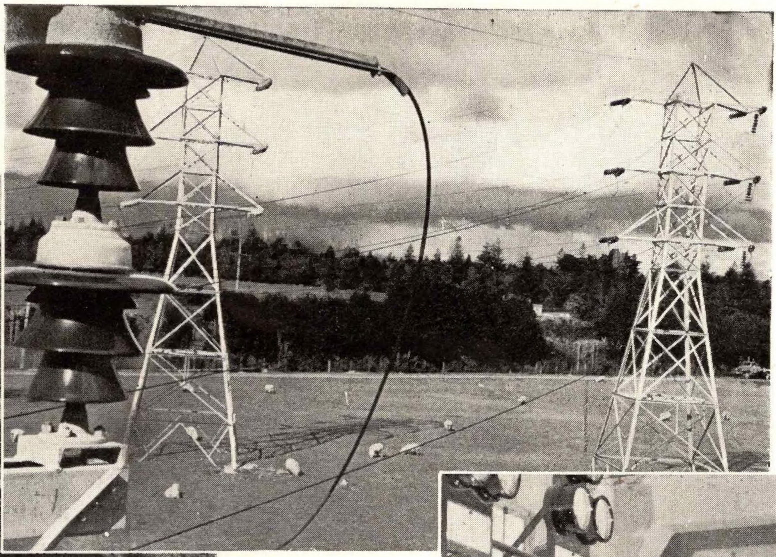


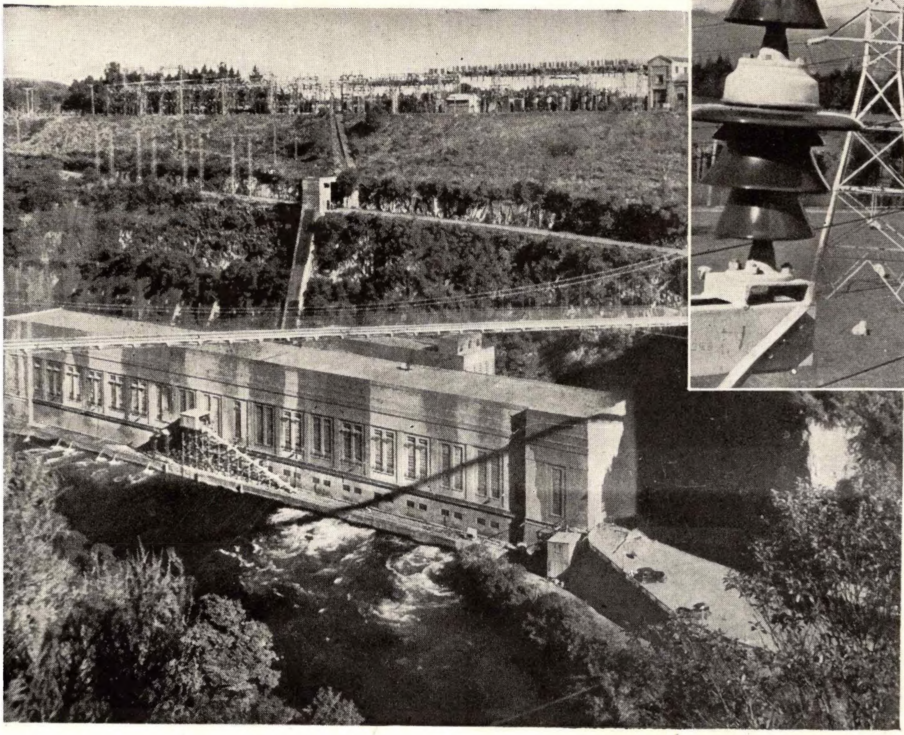
KEYPOINTS

HAMILTON in the North Island and Addington in the South are the locations of what are called Load Dispatch Offices. The engineers in charge of these offices are in constant touch with generating and sub-stations by telephone and radio, and control the whole network so as to meet the fluctuating demand for power at any hour, day or night. The country's main distribution system amounts to more than 34,000 route miles of line.

From Powerhouse to Consumer

Pylons carrying power from Arapuni.

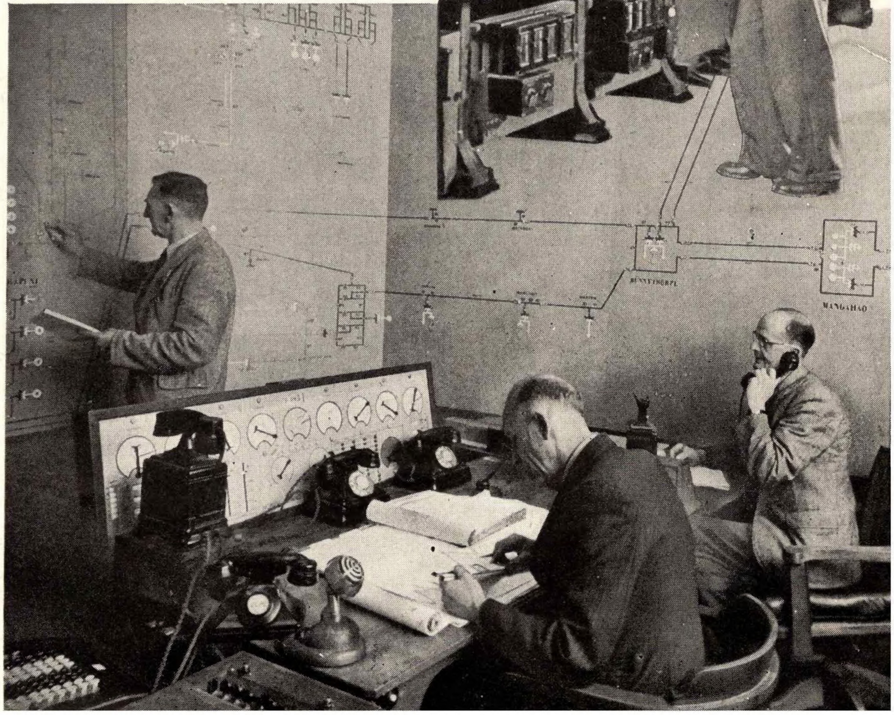




156,000-kilowatt Arapuni, on the Waikato.

11,000-volt switch gear at Claudelands.

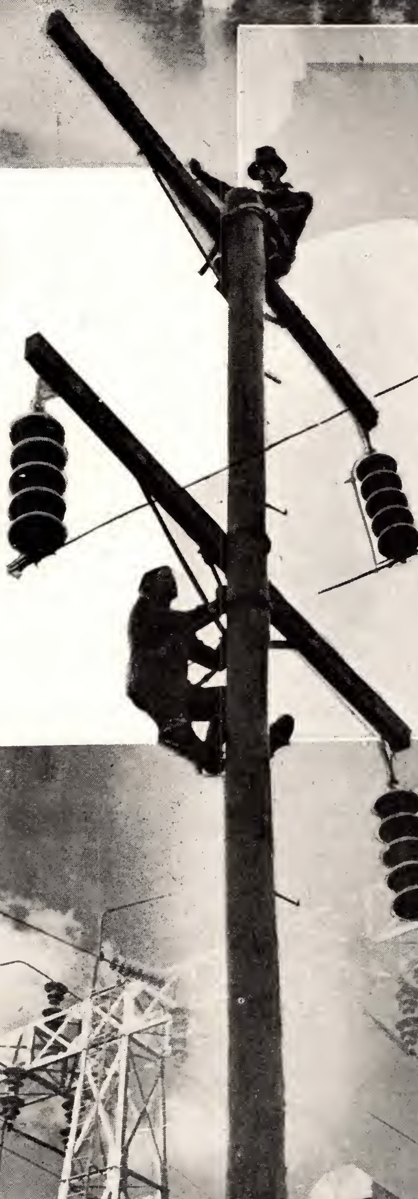
THE path of the power from generating station to ultimate consumer is shown in broad outlines on these two pages. For instance, from Arapuni on the Waikato River, the power flashes across quiet farmland to a large substation at Claudelands. Here the Load Dispatch Engineers are in constant touch with the electricity needs of the North Island—as well as with the various factors affecting supply.



Load Dispatch Office, Claudelands — the whole North Island power network is mapped on the walls.

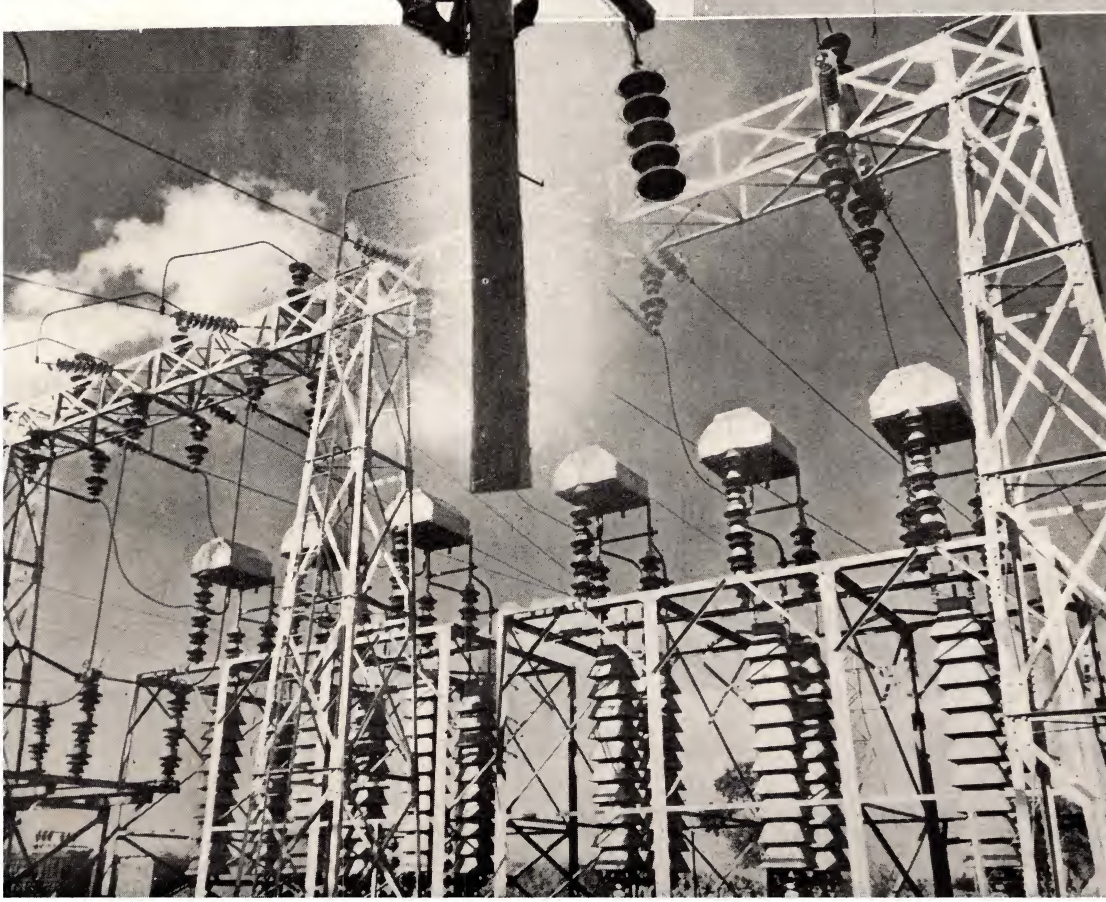
THIS page shows how the power is distributed through the sub-stations of the various supply authorities to the consumers. At these sub-stations the power is broken down by transformers to lower voltages for distribution over the district, until it reaches the ultimate consumer — farmer, housewife, and factory worker. The generation and transmission of electric power is a 24-hour job, and every link in the chain is vital.

Power on the farm. Milking - machines increased tenfold from 1925 to 1948.

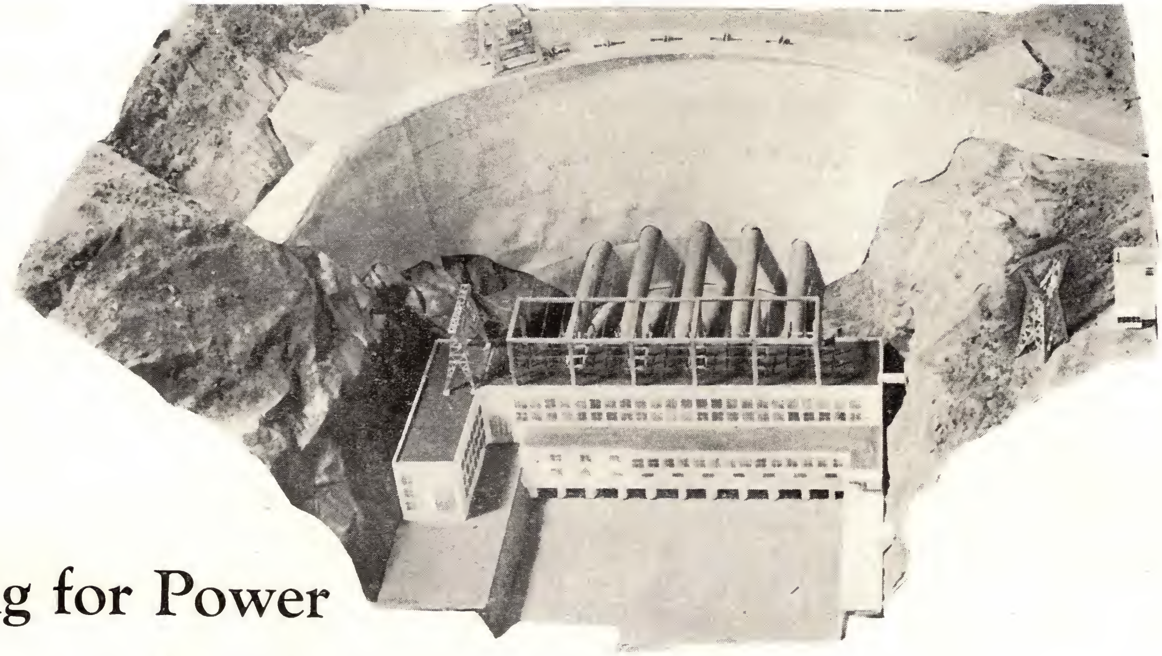


Keeping the lines in order. These men are on call day and night.

All-electric kitchen is standard for many homes.



Penrose Sub-station, Auckland, where the power is transformed to low voltage for retailing to consumers.



Scale model of Maraetai's 180,000-kilowatt station, now building on the Waikato.

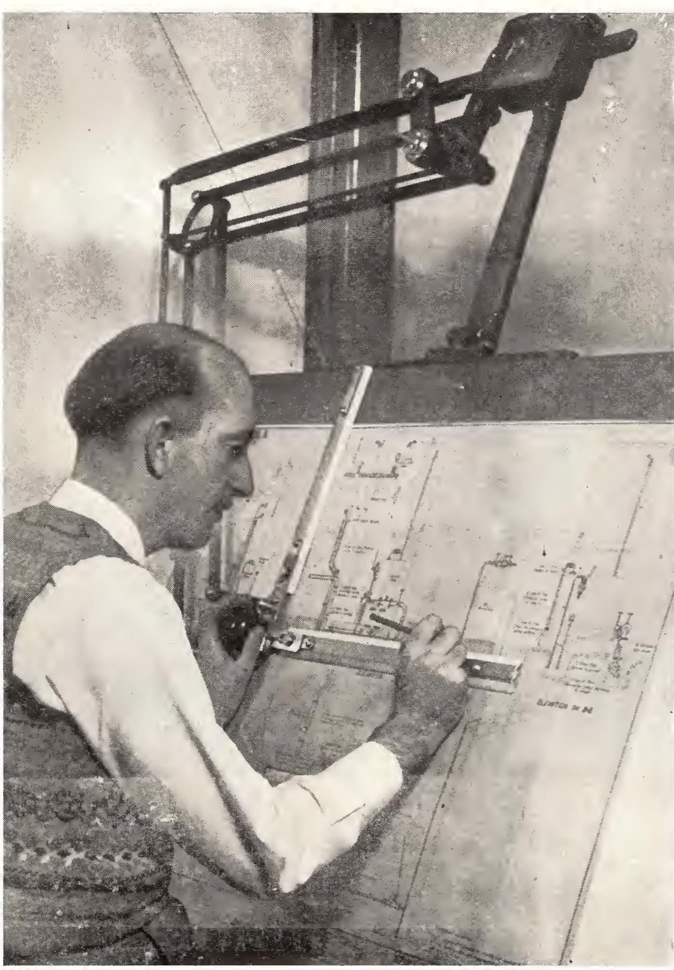
Planning for Power

THE planning and construction of a hydro-electric power scheme are immense undertakings. Few people outside engineering circles realise that a power scheme such as Karapiro or Maraetai may require more than 2,500 final drawings; even a large sub-station may need more than 300 drawings in the design stage alone.

Scale hydraulic models must be made—by the Dominion Physical Laboratory—to test water flow; specifications must be written covering every part of the work, and different parts grouped into contracts for manufacture or construction; there is endless research into materials, methods and equipment.

All this civil engineering work, from the research and drawings to the finished concrete dams and spill-ways, is carried out by the Ministry of Works, to the general requirements of the State Hydro-Electric Department, which itself looks after the design and installation of turbines, generators, transformers and transmission lines, with their many substations, from Kaitaia to Invercargill.

Head office draughtsman. Thousands of drawings are needed for each scheme.



Experimental hydraulic model of a spillway intake. The white streaks are pieces of confetti; slow-exposure photographs register their motion, revealing flow characteristics of water passing through intake. As the figures in the photograph indicate, the exposure was one-fifth of a second, and the rate of flow of the water represented 25,000 cubic feet a second.

Surveyor working 200 feet above site of Maraetai, on Waikato River. All possible sites for power schemes must be carefully investigated and checked.

INVESTIGATION:

On the Surface–

FEW laymen realise the tremendous amount of preliminary investigation and surveying required before design or construction can begin. Engineers and surveyors must tramp miles and miles of country finding and checking sites for power schemes. Aerial photography is of great assistance at various stages, but ground parties must spend months surveying rivers, lakes and watersheds.

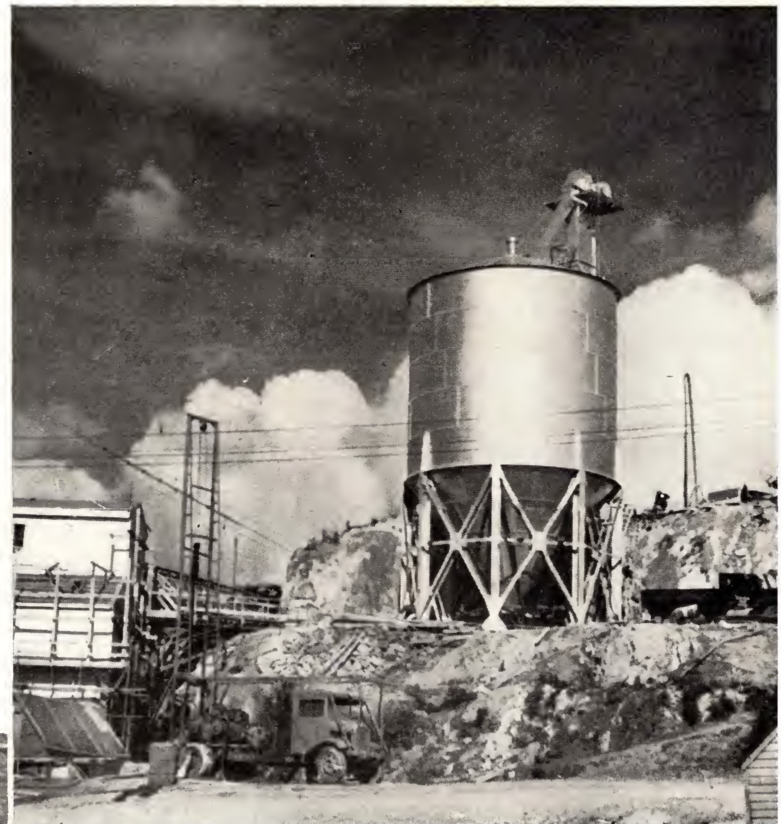
Hydrology records—relating to rainfall, evaporation, run-off and everything concerning the flow of water in rivers—must be compiled and studied so that accurate long-term forecasts can be made. New Zealand's hydrology and climate records go back 30 to 50 years.

And Below

NOT only the surface of the earth, but also what lies beneath must be carefully investigated by the planners of hydro-electric works. Geologists trace probable rock formations from surface evidence; geophysicists check by tracing the paths of sound waves and electrical waves through the underlying rocks.

Shafts are sunk and tunnels driven; bore-holes are drilled to bring up earth and rock samples from great depths—in the Waikato basin some penetrate below sea-level. Water is pumped into the holes to measure leakage, and cement grout forced in to see if leakages can be blocked. Making use of all such aids, the engineer and the geologist finally piece together a clear picture of the structure of the country.

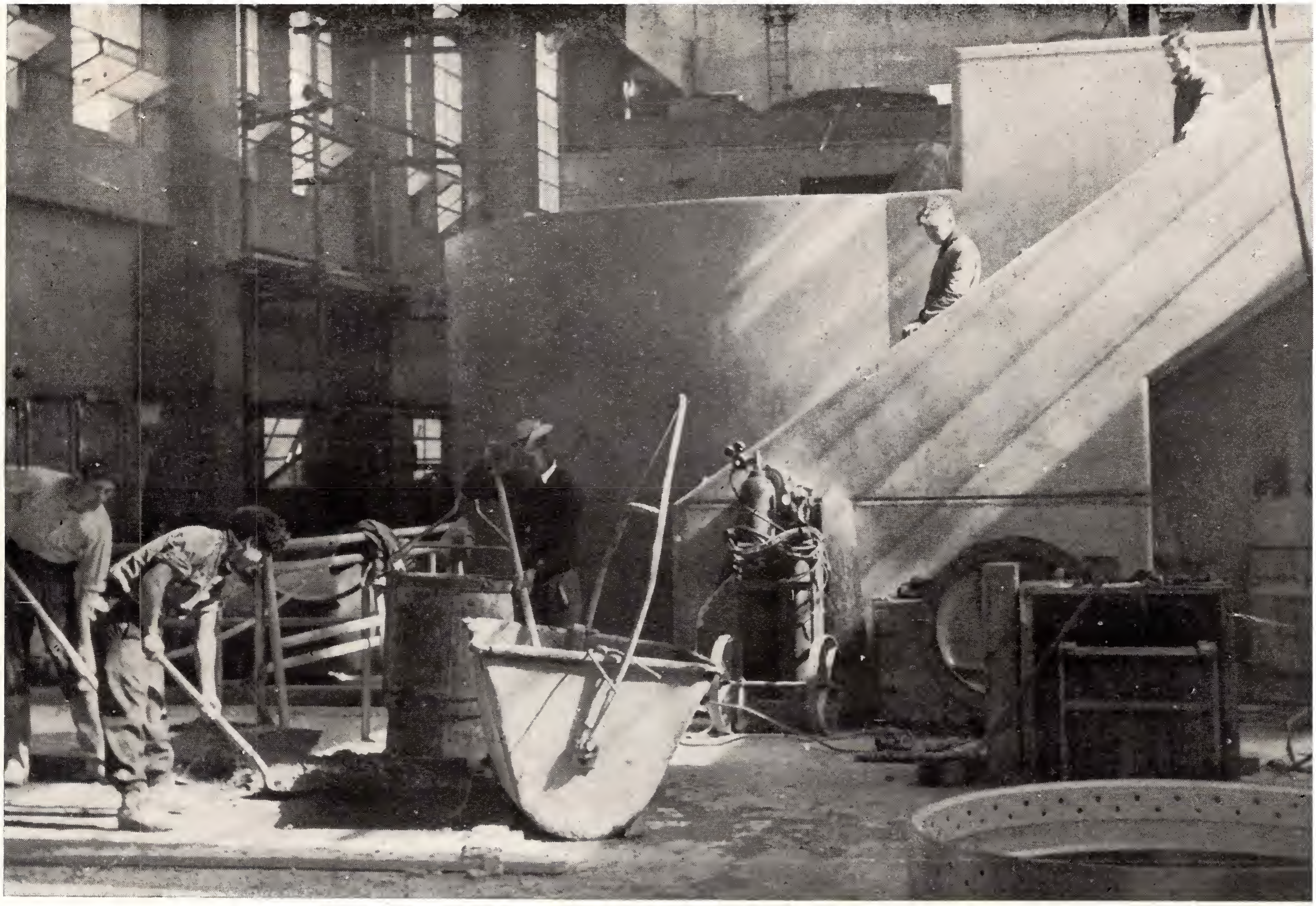
Men, Machines and Materials



Maraetai has three of biggest concrete mixers built in Britain; 500,000 tons of concrete are needed for this job.

Section of Karapiro penstock being installed — hydro-electric schemes will absorb half of available structural steel.

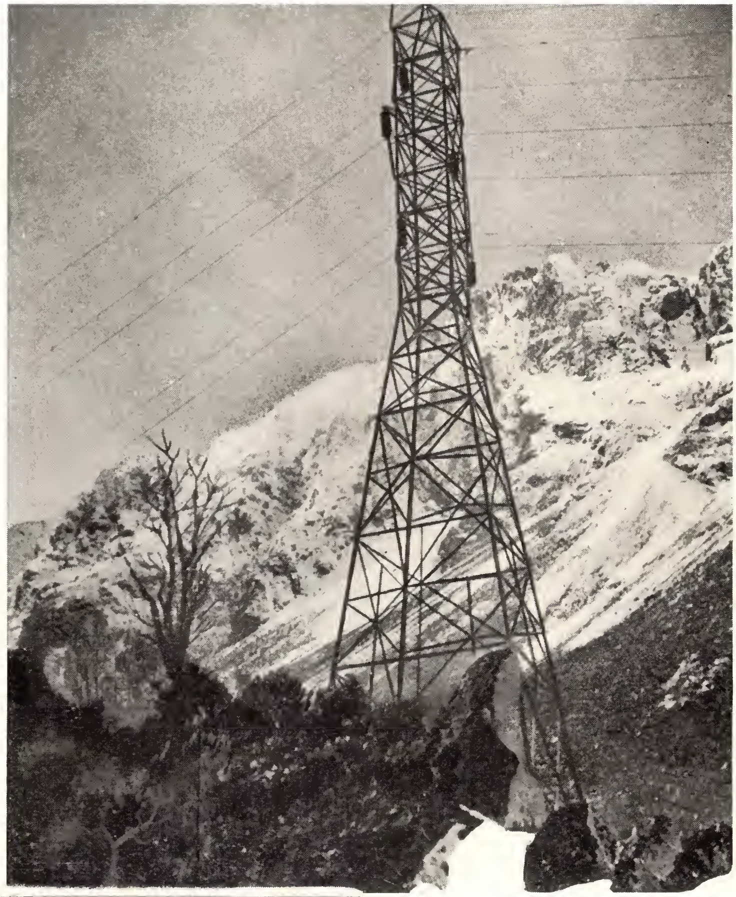
Tekapo tunnel—the night shift "brews up". New Zealand tunnellers are known the world over for their record performances. However essential machines and materials—steel and concrete—may be, all depends on the quality of the men.



Above: *Completing powerhouse at Kaitawa, which began generating power in 1948.*

Below: *Kaitawa pipeline made of steel imported from hard-pressed overseas producers.*

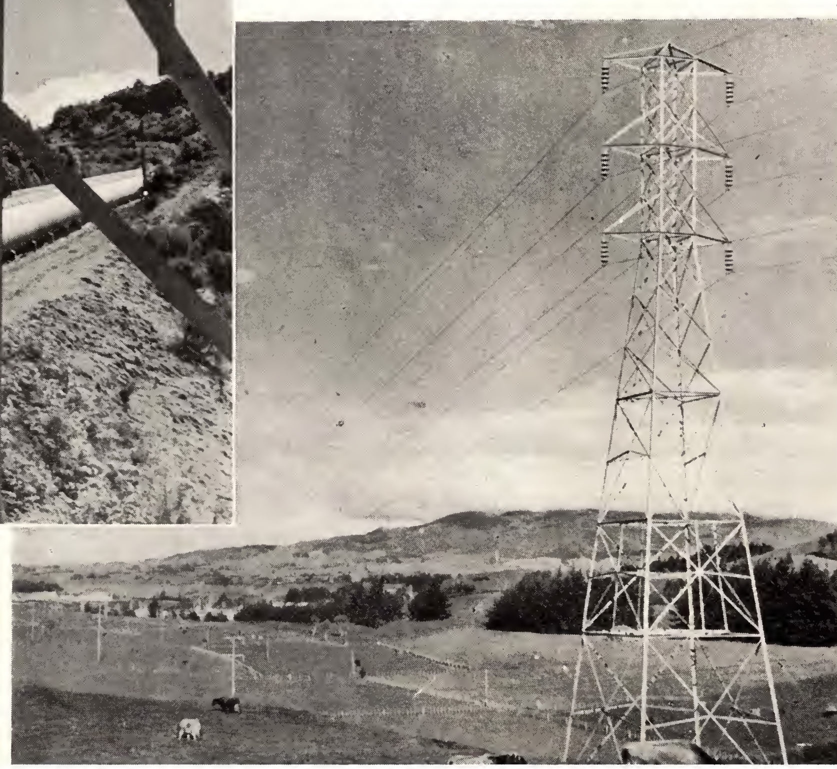
March of the Pylons



Erection of this line through Arthur's Pass makes an exciting chapter in New Zealand's story of electrical progress. A large proportion of the pylons are made in the Dominion.

Symbols of hydro-electric power — Tuai's pipelines and pylons at Lake Waikaremoana. Pylons must have high safety factor to withstand all possible stresses.

OVER undulating farm lands, across mountain passes, past busy towns, march the tall pylons carrying the power on which New Zealanders depend so much. Soon 220,000-volt lines will be erected through the heart of each island. Such lines, with inch-thick cables, will reduce transmission losses over long distances. They are carried by steel towers from 55 to 90 feet high, with cross-arms up to 50 feet long. About 1,300 such pylons are needed for the first North Island 220,000-volt line.

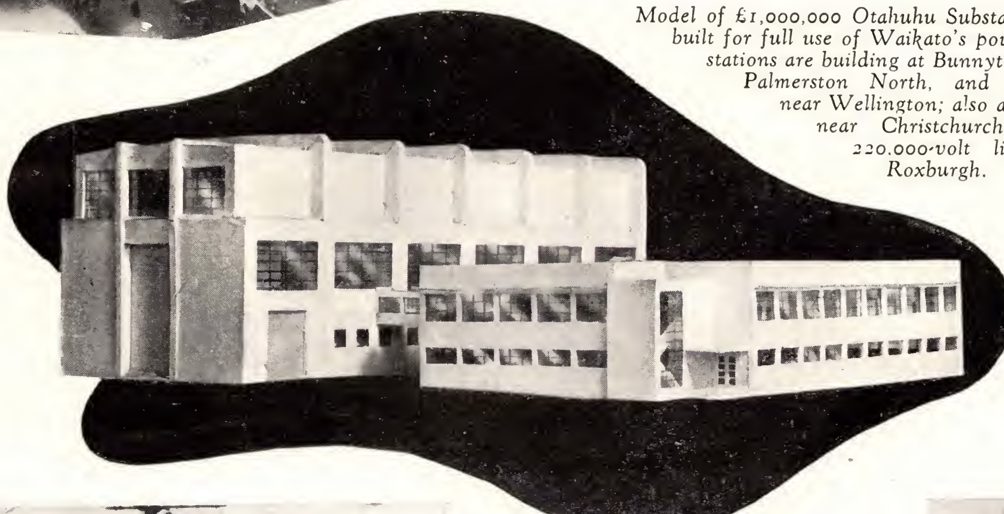


Construction over country is planned for minimum interference with farming operations.

THE SUBSTATIONS

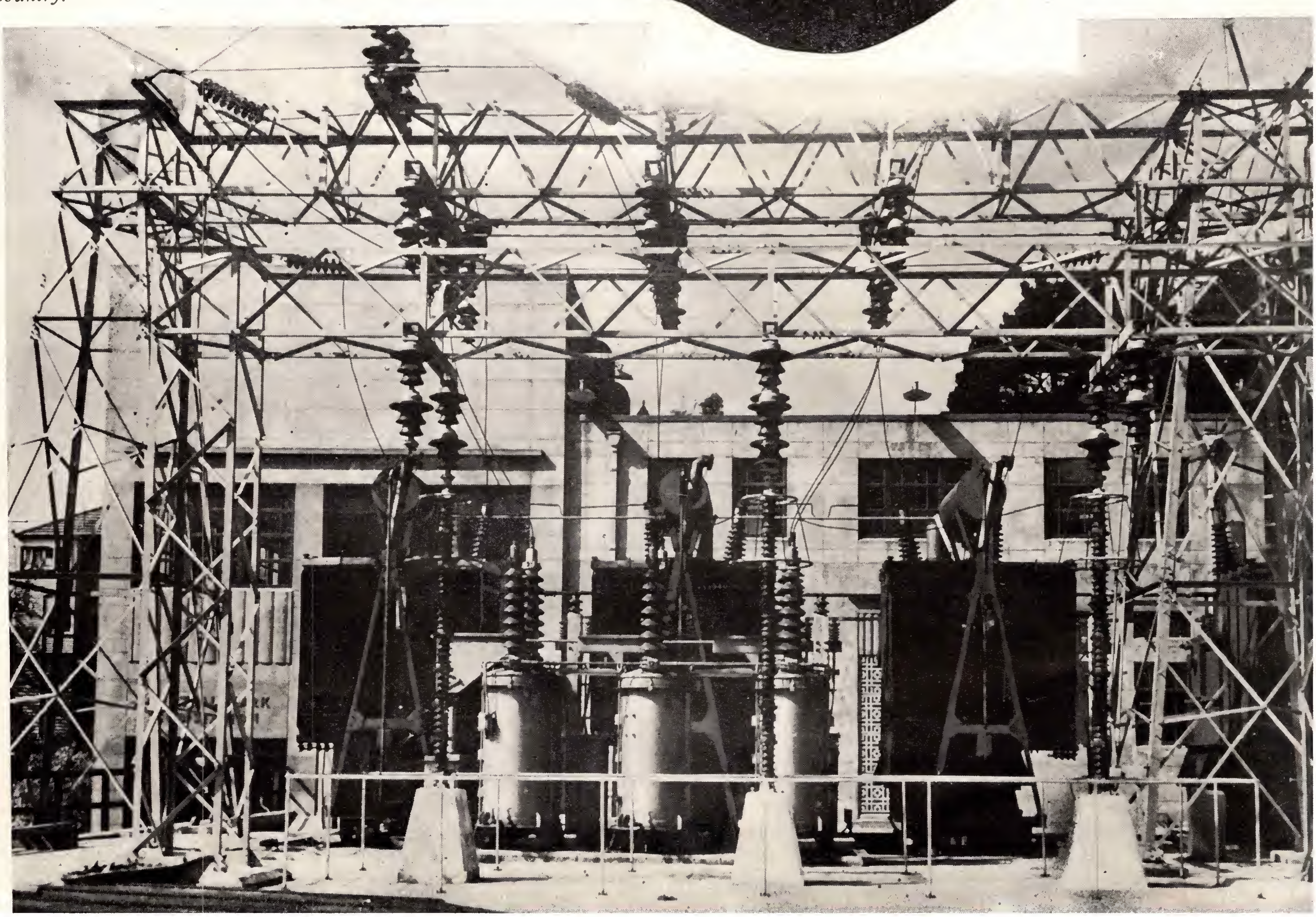
THE main job of the substations is to receive power at high tensions, and break it down to a lower voltage for delivery to the power supply authority. Most of the power is generated at 11,000 volts, but before leaving the power house it is stepped up to 33,000, 66,000 and 110,000 volts. From the substations it is reduced again, until it reaches the consumer at the standard tension of 230 volts.

Claudelands substation is in constant touch with all supply and demand points in North Island.

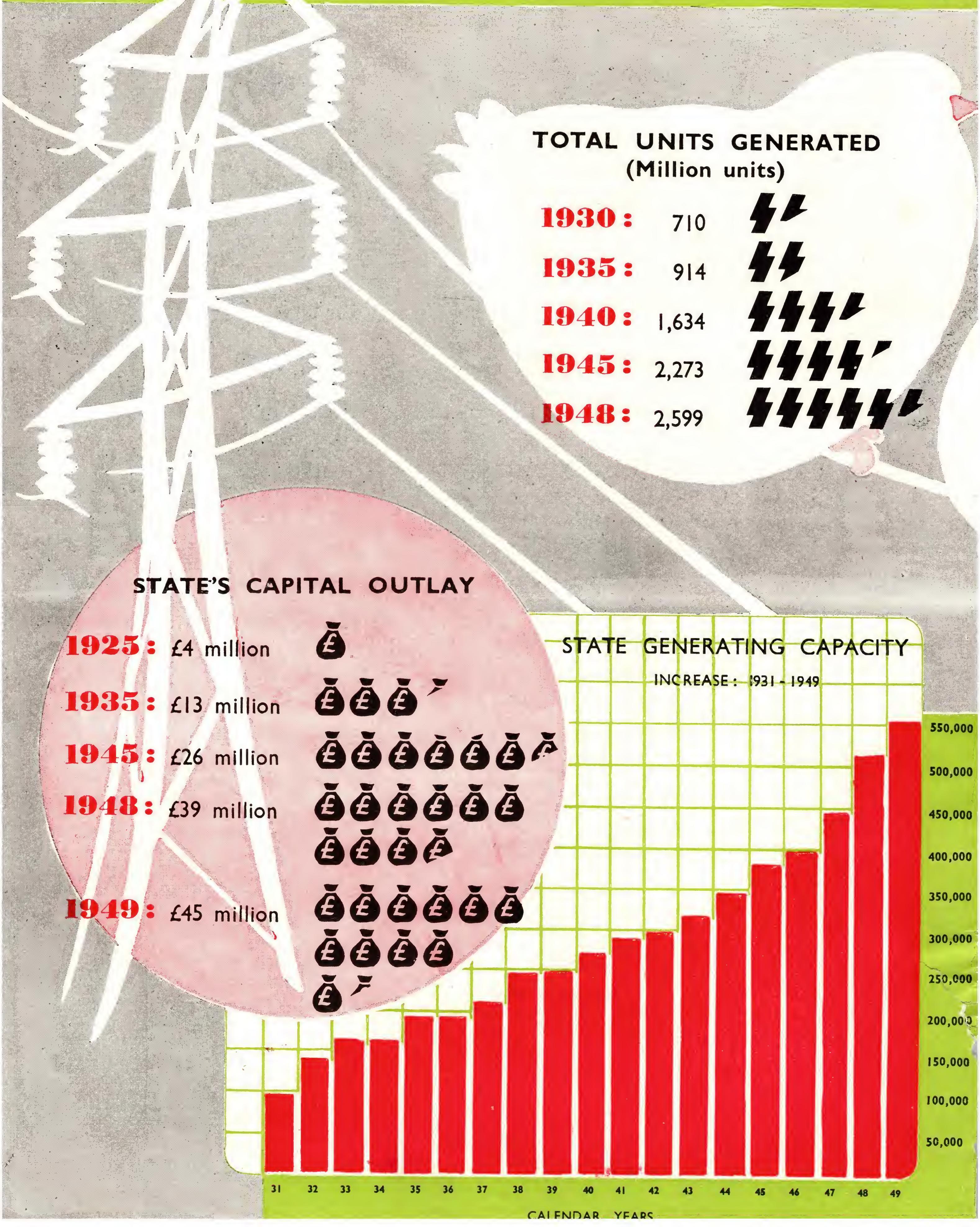


Model of £1,000,000 Otahuhu Substation, being built for full use of Waikato's power; similar stations are building at Bunnythorpe, near Palmerston North, and Haywards, near Wellington; also at Islington near Christchurch, for the 220,000-volt line from Roxburgh.

Central Park Sub-station, Wellington, one of scores distributing power throughout the country.



Supply and Demand in Electric Powe



—the System and its Loads since 1930:

CONSUMERS

1930:	284,235
1935:	342,334
1940:	426,354
1945:	473,837
1948:	511,699

ROUTE MILES OF LINE

1930:	19,128
1935:	21,707
1940:	27,358
1945:	30,167
1948:	34,044

ELECTRIC RANGES

1930:	24,690
1935:	35,841
1940:	84,160
1945:	135,663
1948:	180,936

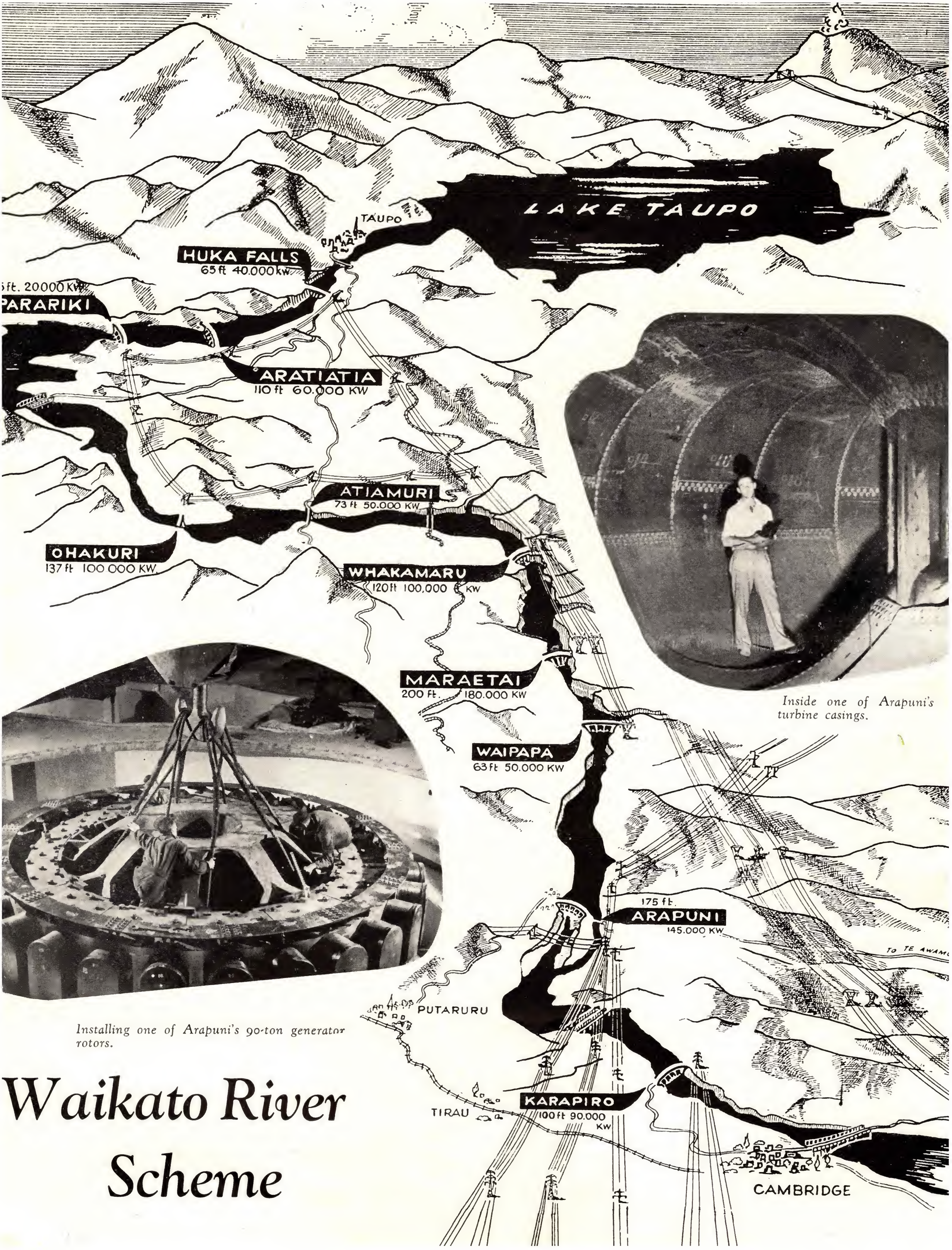
WATER HEATERS

1930:	37,564
1935:	53,635
1940:	106,948
1945:	160,694
1948:	212,482

MILKING MACHINES

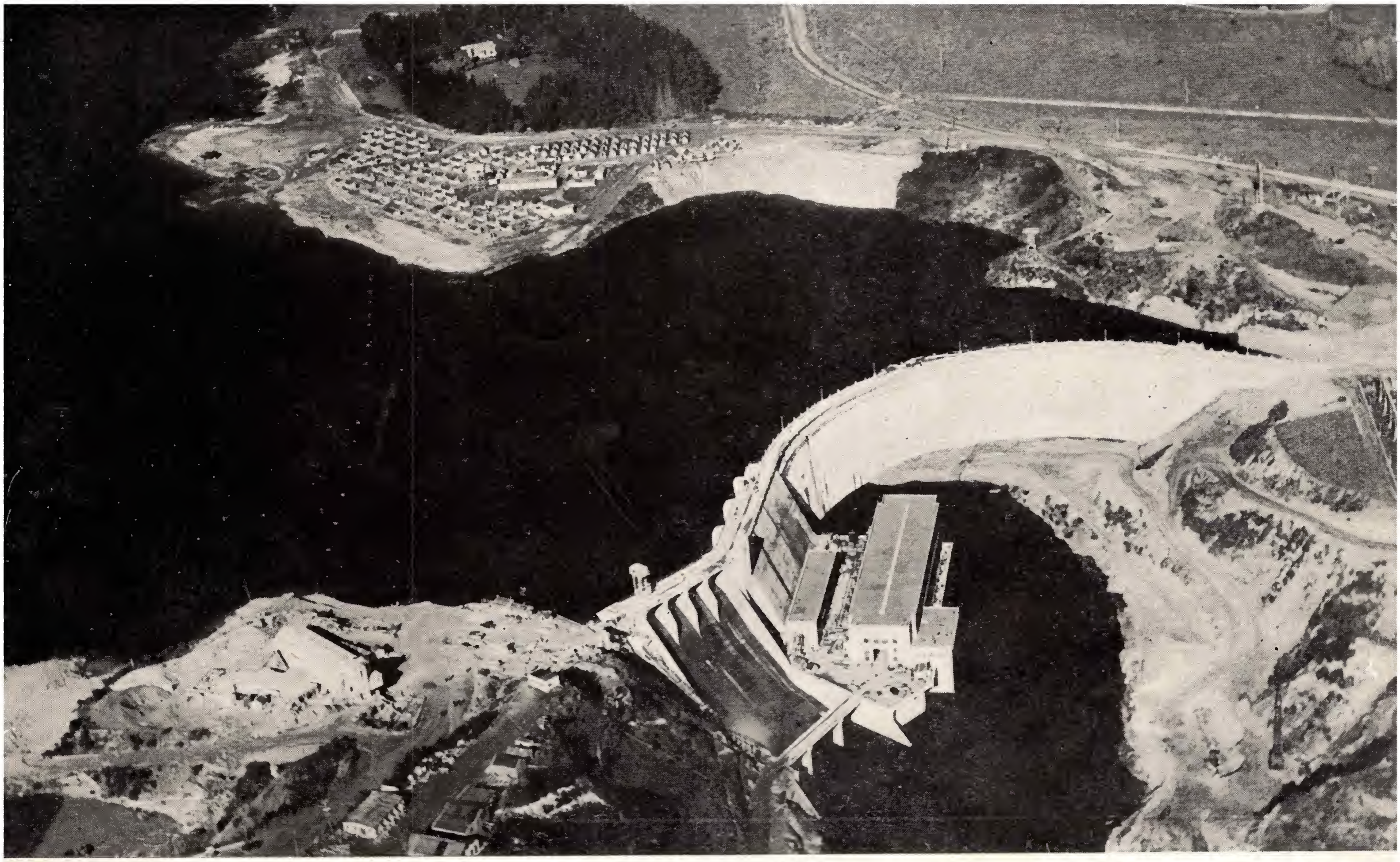
1930:	11,922
1935:	17,200
1940:	27,183
1945:	31,181
1948:	35,687

Waikato River Scheme



Inside one of Arapuni's turbine casings.

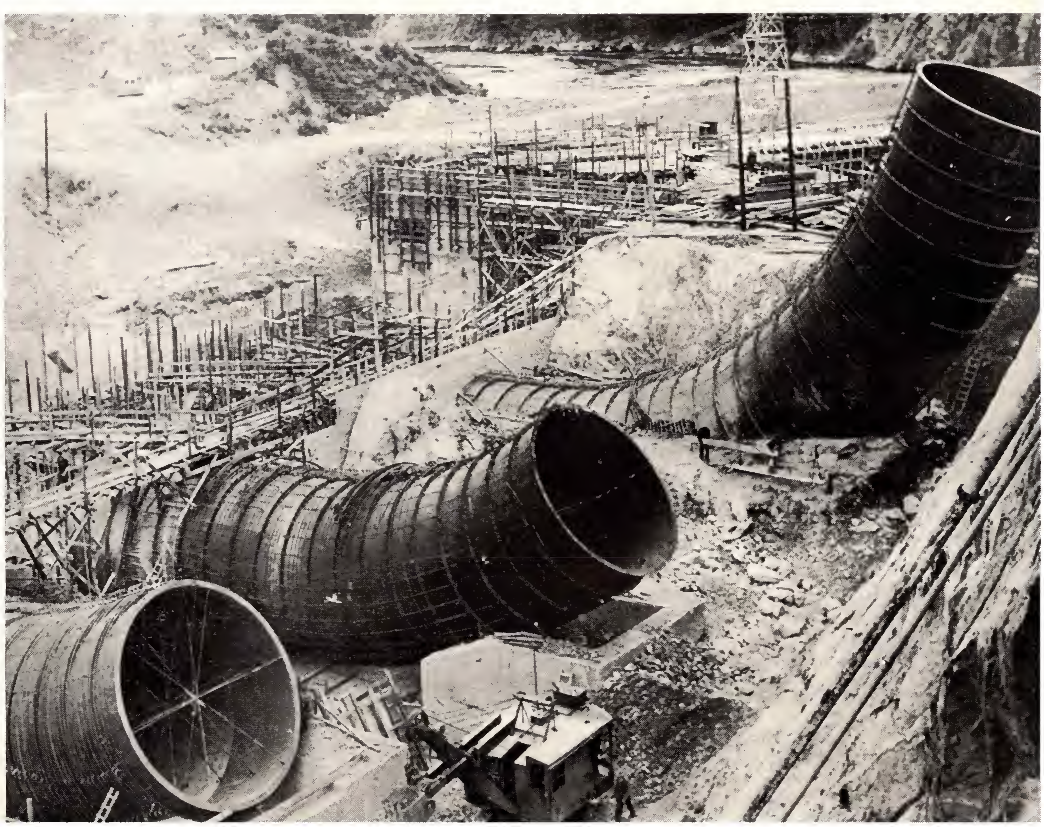
Installing one of Arapuni's 90-ton generator rotors.



Second of ten — Karapiro's 170ft. high dam took 220,000 cubic yards of concrete.

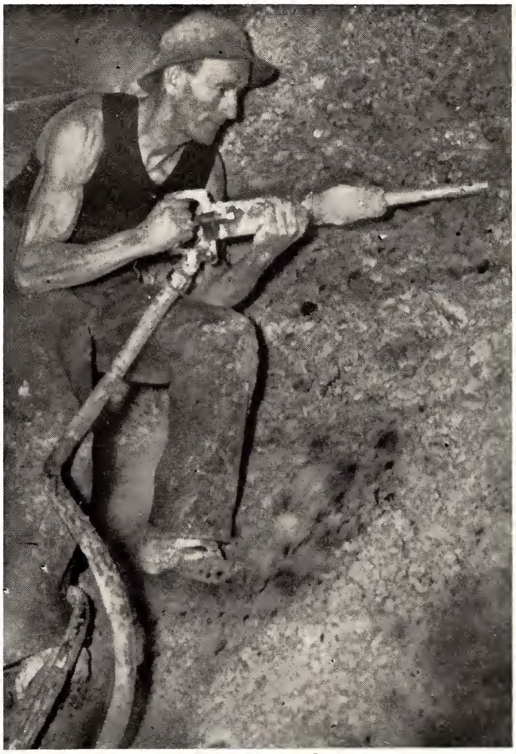
Karapiro

ALTHOUGH the older Arapuni is nearly twice as powerful, 90,000-kilowatt Karapiro, largely built during the war, has come to be a symbol of the unremitting efforts being made to catch up with the potential demand for electric power in New Zealand. Karapiro is the second of the projected 10 stations on the Waikato River, and will be followed by giant Maraetai, now building. The ten stations, to produce over 1,000,000 horse-power, will use just the same amount of water as the existing two. But the present output of electric power will be trebled. The annual output will be the equivalent of more than 3,000,000 tons of coal—which exceeds New Zealand's total coal production in any year.



All steelwork was prefabricated on the site for Karapiro's 21 ft. wide penstocks

Maraetai:



Maraetai tunneller — workers were often knee-deep, even waist-deep in water.

Right: *After blasting of rock barrier, dragline clears debris from tunnel mouth; tunnel is 25 feet across—same as traffic tunnel through* Mt. Victoria, Wellington.

Below: *Outlet of 1,685-foot diversion tunnel, which took two years and a half to build.*

Spillway intake to tunnel, 180 feet above diversion intake (which will be closed when dam is erected). Inset above is hydraulic model of spillway intake. Maraetai gorge is so narrow, powerhouse must stand in riverbed, below dam, preventing use of orthodox spillway over dam itself.

TWENTY-ONE miles above Arapuni, work is being pushed ahead on great Maraetai, which will be New Zealand's biggest power station, until the construction of Roxburgh and Benmore in the South Island. If there are no serious hold-ups in labour and materials Maraetai should begin generating power in 1951.

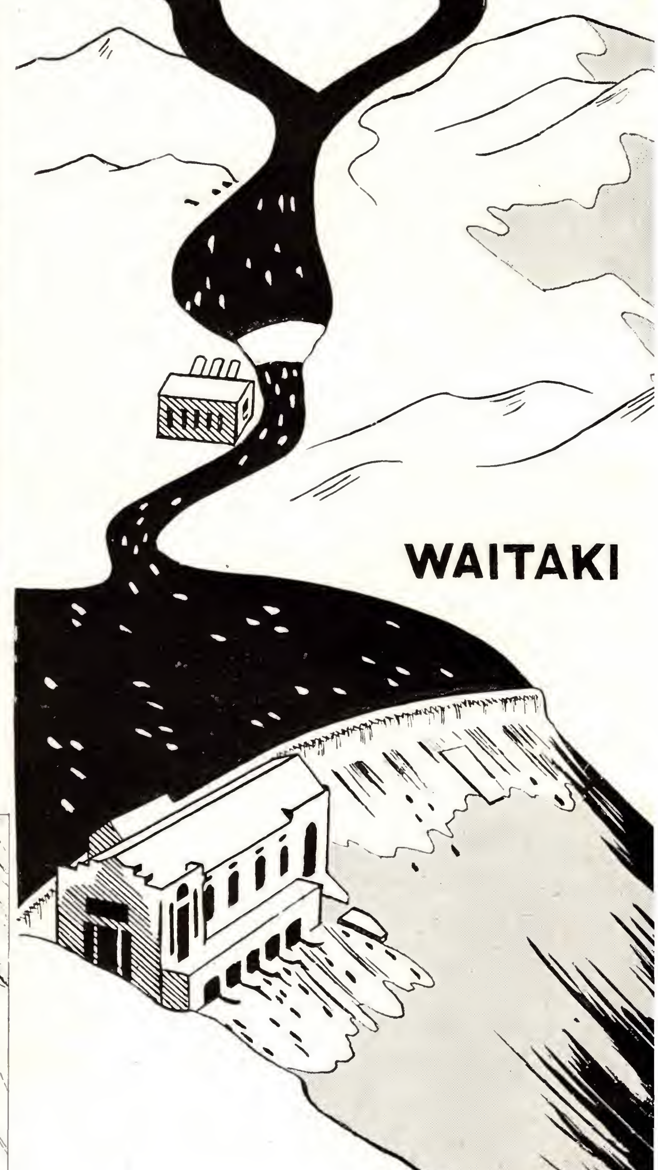
The 280-foot high arch dam will need 110,000 cubic yards of concrete. About 5,000 tons of steel will also be used in the scheme.

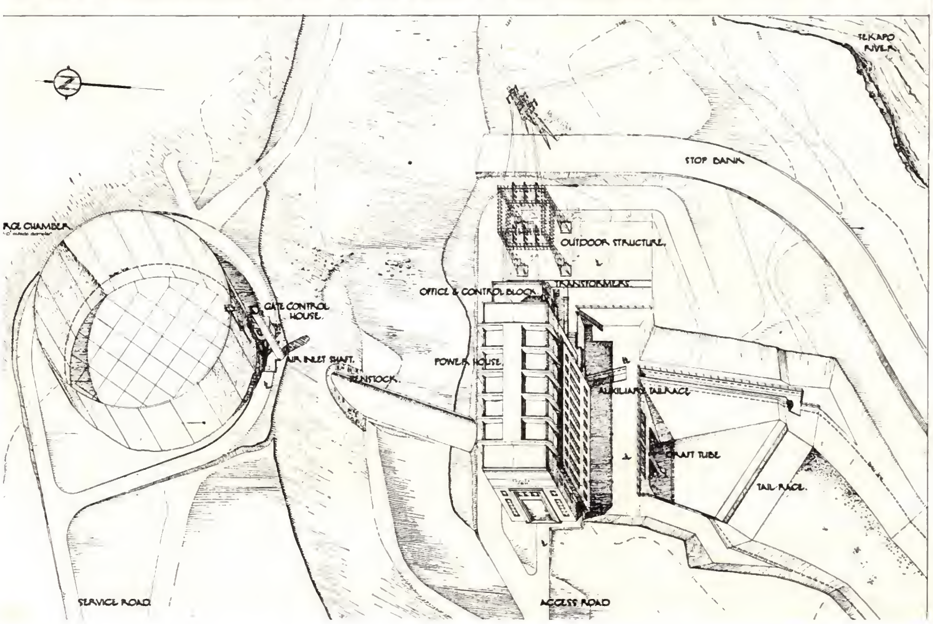
a River Diverted

Below—Upper picture: *The Waikato flows through the diversion tunnel.* Lower picture: *Bull-dozing the lower coffer-dam across the river, just above tunnel outlet. Upper coffer-dam, just below tunnel intake, has since been erected, and riverbed between pumped dry for construction of permanent dam. Diversion tunnel will eventually be used as spillway.*

There will be five main generators, each of 36,000 kilowatts, with two auxiliary units each of 750 kilowatts. The five penstocks will be 16 feet in diameter and 250 feet long. By world standards, Maraetai is a major engineering job.

The diversion tunnel will take the full flow of the Waikato River for the next two years, while the 450-foot long dam is being built. Work has already begun on the site of the next station, Whakamaru, eight miles upstream.





Tekapo's power station: Above left—how it is being built, and lower—how it will look.

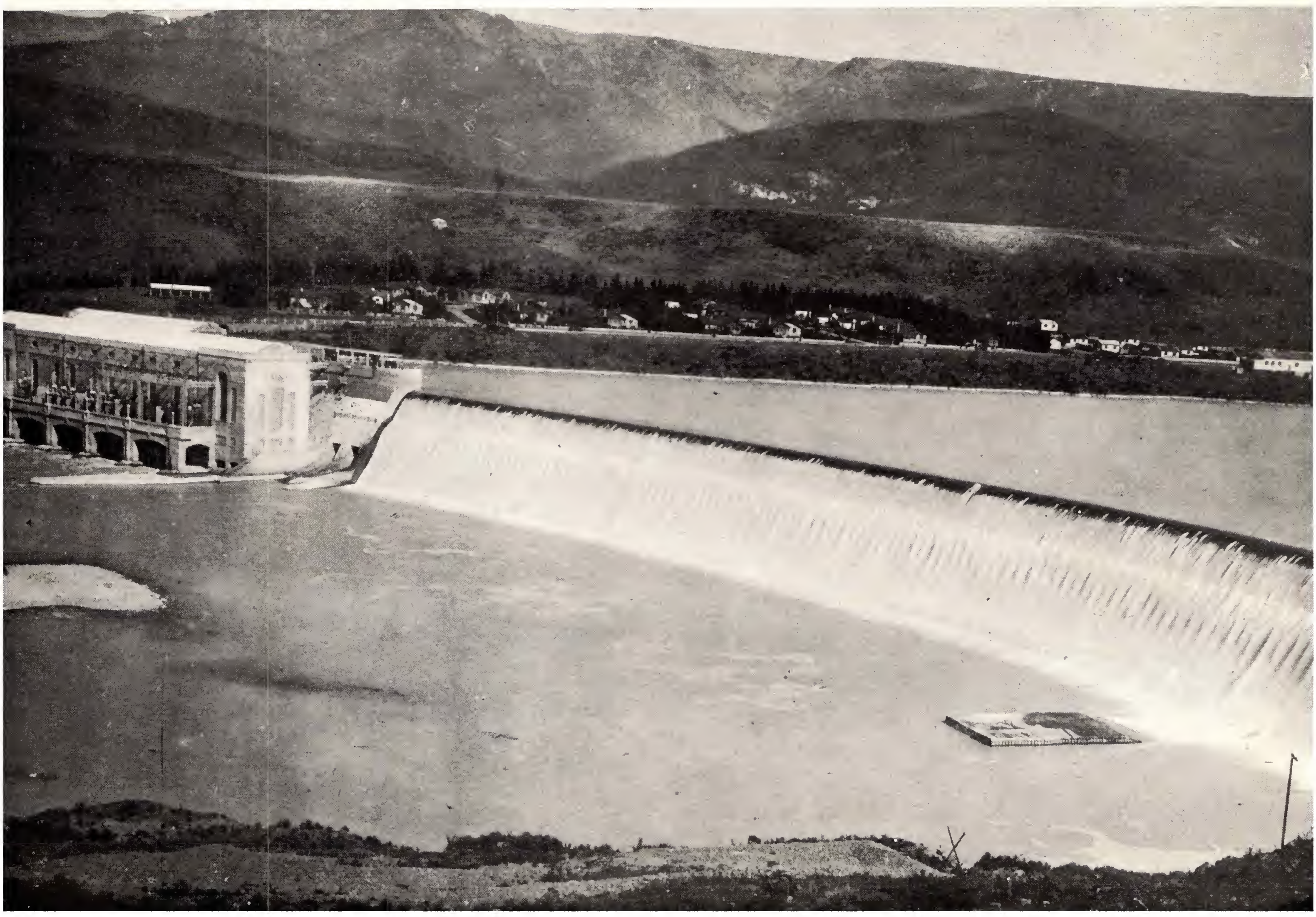
The Waitaki

THE schemes at the source of the Waitaki River in South Canterbury are essentially to provide an adequate flow of water for hydro-electric purposes the whole year round. Dams are therefore being built to control Lakes Pukaki and Tekapo, so that spring and summer water can be stored for release during winter. Substantial storage of water is already available in Lake Pukaki. A 25,000-kilowatt station is also being built at Tekapo to use the water flowing through the outlet tunnel before it reaches the river lower down. It should be in operation by the end of 1950.

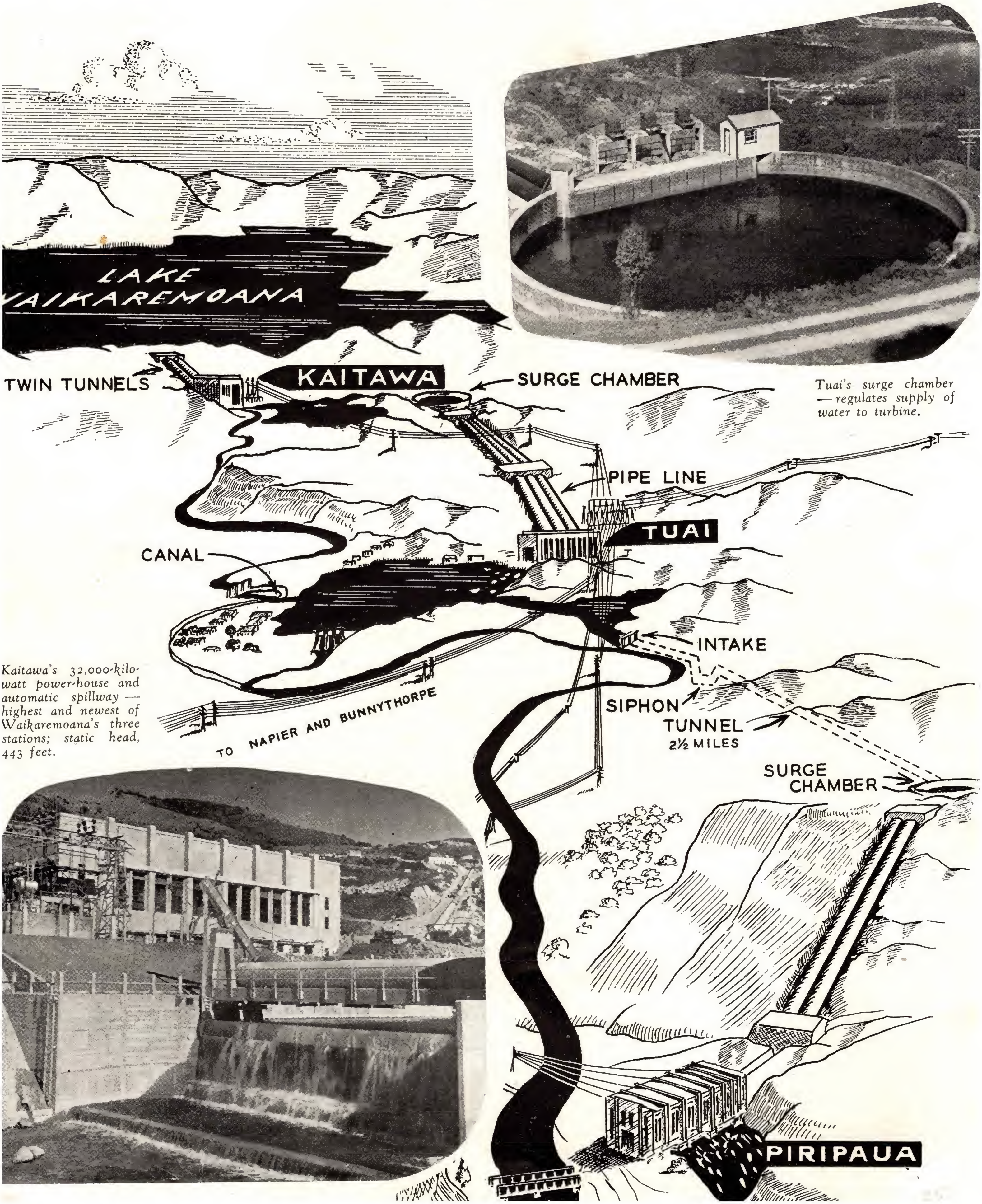
The Waitaki River is estimated to have a potential of more than 1,000,000 horsepower—equal to the Waikato, and 300,000 horsepower more than the Dominion's present output. The Waitaki station, with a capacity of 75,000 kilowatts, was opened in 1934, and its fifth 15,000-kilowatt unit was installed in 1949. One of New Zealand's greatest schemes—Benmore—is projected at Black Jack's Point, nearly 30 miles further up the river.

Tekapo's mile-long, 20ft. tunnel, with initial lining of precast concrete blocks; final cement lining will be smooth.

Floodwaters pouring over the spillway at Waitaki.



Waikaremoana's Triple



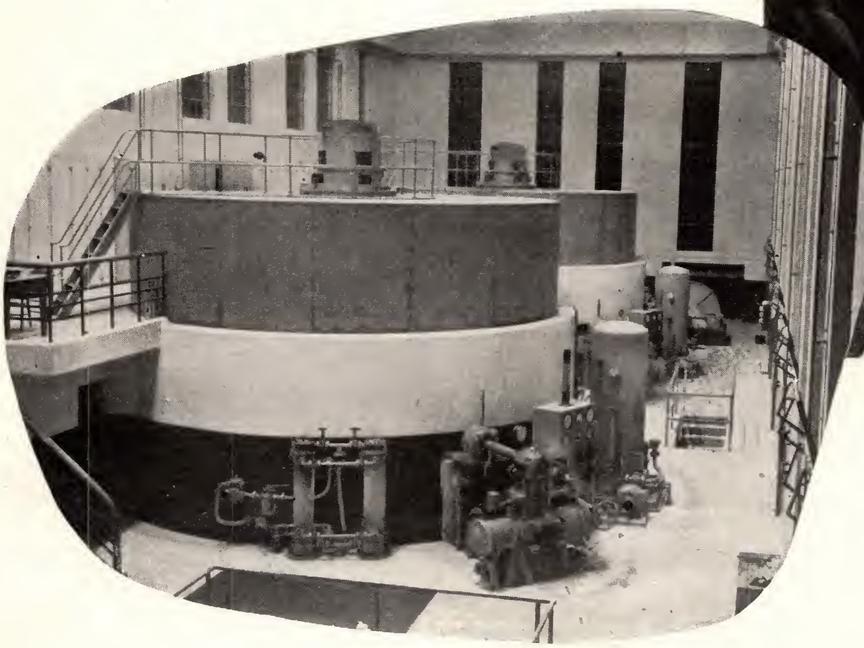
Tuai's surge chamber — regulates supply of water to turbine.

Kaitawa's 32,000-kilowatt power-house and automatic spillway — highest and newest of Waikaremoana's three stations; static head, 443 feet.

Scheme

Tunnel driven under lake-bed, to draw off water for three stations generating 124,000 kilowatts.

Modern power-house — 40,000-kilowatt Piripaua, lowest of three; static head, 370 feet.



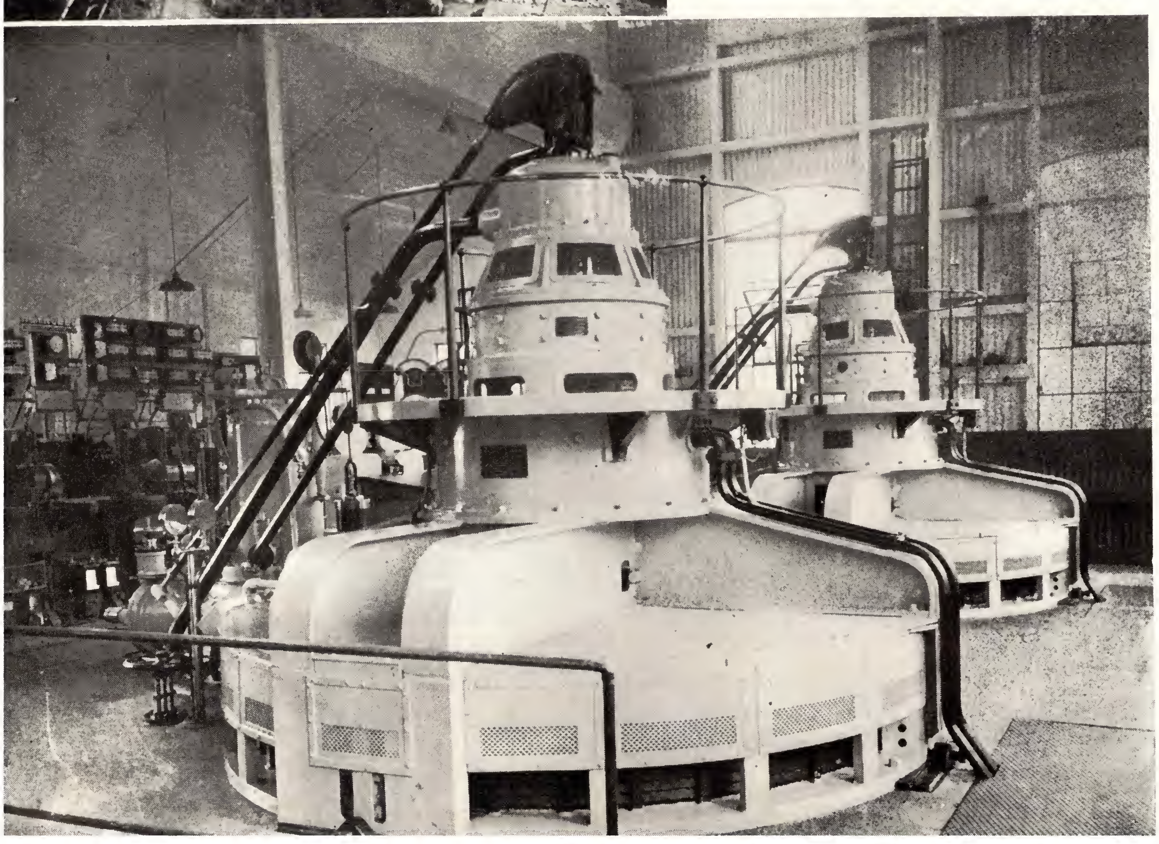
Water falls 676 feet through three pipelines to 52,000-kilowatt Tuai, middle station.

Junior Partners

INCLUDING Coleridge, there are six important minor hydro-electric stations spread over the North and South Islands. In the North there is Mangahao, near Wellington, with a capacity of 19,200 kilowatts completed in 1925. The South Island has Cobb Valley, in the Nelson Province; Highbank, on the irrigation channels in Mid-Canterbury; Kaimata, on the Arnold River in Westland, and Lake Monowai, in Southland.

Cobb, whose 12,000 kilowatts are being increased to 32,000 by extensions now building, forms an independent system with the Stoke diesel station at Nelson. Highbank is a modern 25,200-kilowatt station on the Rakaia River, using water not needed for irrigation. The Kaimata station was the first in the Southern Hemisphere to use a Kaplan turbine, and generates 3,060 kilowatts from the Arnold River, near Greymouth. Monowai, near Invercargill, generates 6,000 kilowatts from the Waiau River.

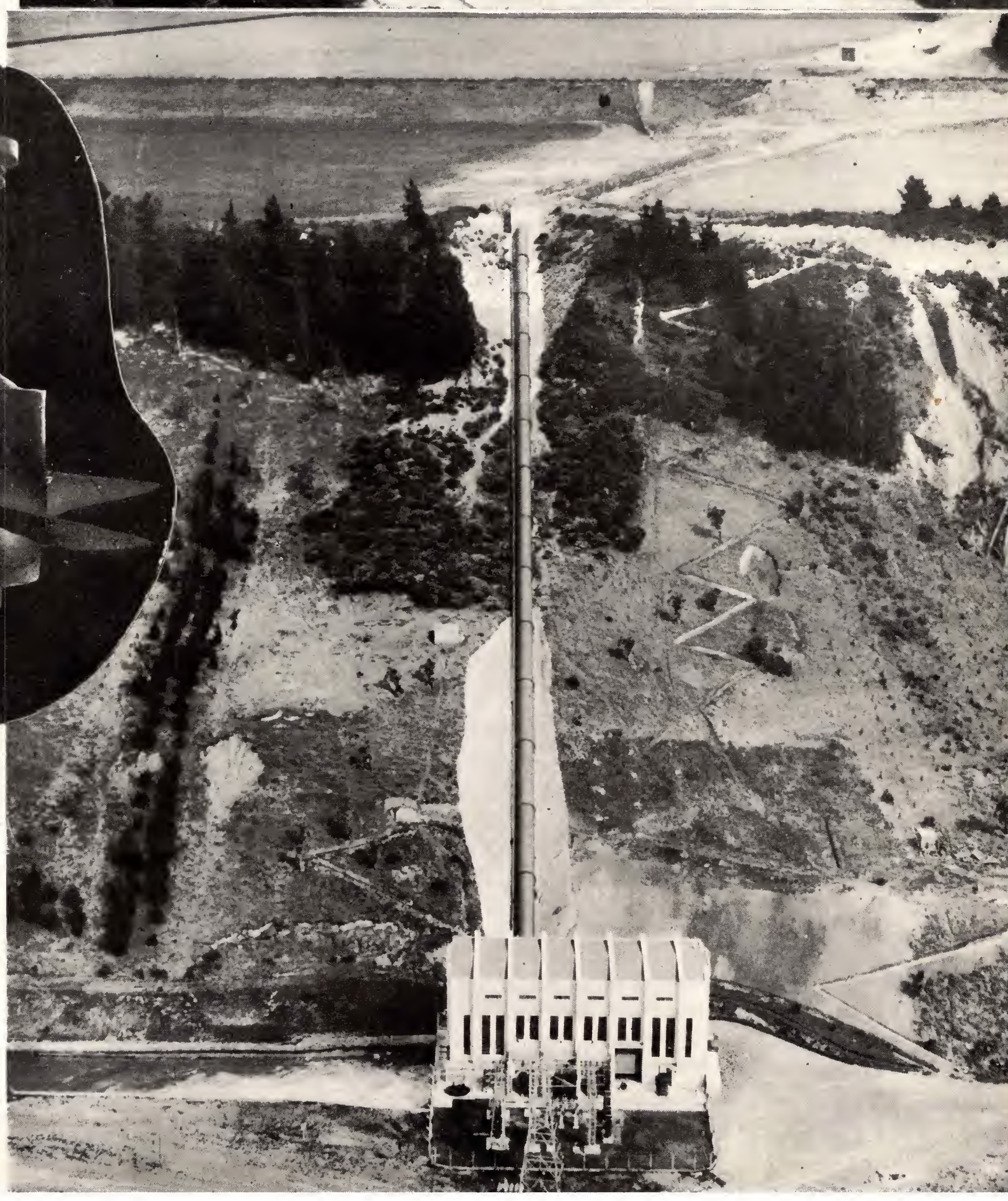
Cobb has greatest static head in New Zealand—water drops 1,876 feet, through 7,000 ft. pipeline which follows 6,000 ft. tunnel; 100 ft. high dam in Cobb Valley will create 7-mile long storage lake.



Greymouth's station at Kaimata, on Arnold River; static head, 42 feet.

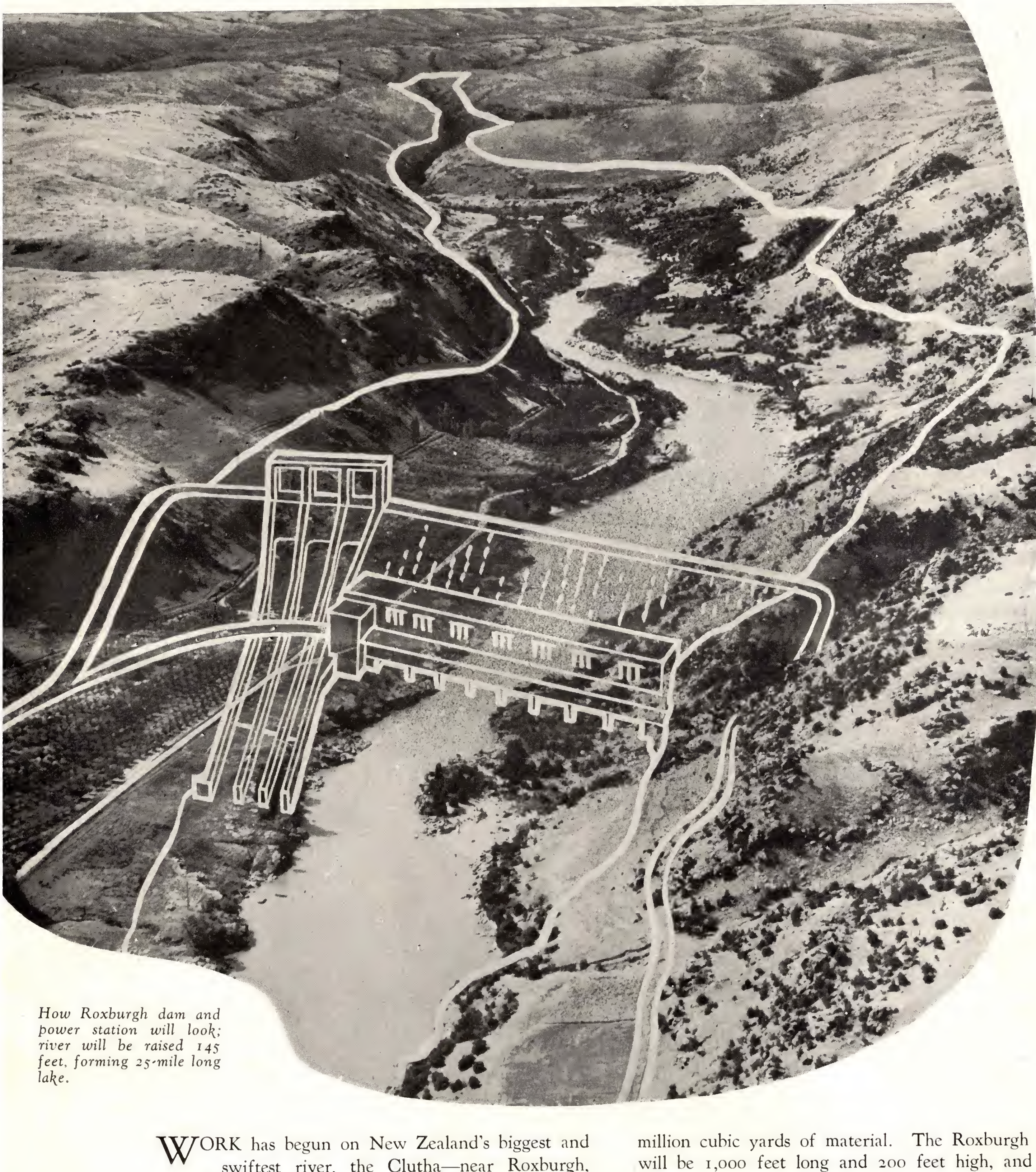
Top dam at Mangahao—needle valve controls outflow. Static head at power station 896 feet.

One of Kaimata's Kaplan turbines.



Highbank's penstock is supported on roller bearings, allowing for contraction and expansion. Static head, 330 feet. Highbank's 25,200-kilowatt generator is largest unit in country.

Big Scheme on the Clutha



How Roxburgh dam and power station will look; river will be raised 145 feet, forming 25-mile long lake.

WORK has begun on New Zealand's biggest and swiftest river, the Clutha—near Roxburgh, Central Otago—on the construction of a station with a capacity of 320,000 kilowatts. To handle the volume of the Clutha, a 1,500-foot channel is necessary to divert the river from its present bed during construction. This work involves the excavation of half-a-million cubic yards of material. The Roxburgh dam will be 1,000 feet long and 200 feet high, and will absorb 500,000 cubic yards of concrete. The scheme is estimated to cost £13,000,000, and will eventually control the flow from the lakes supplying the Clutha. The Roxburgh scheme alone will treble the capacity of State hydro-electric plants in the South Island.

Black Jack's Point, on Waitaki, with projected Benmore station sketched in; note penstocks on left.

Lovely Lake Roto-iti will figure, with Lake Rotoroa, in power scheme for northern end of South Island.

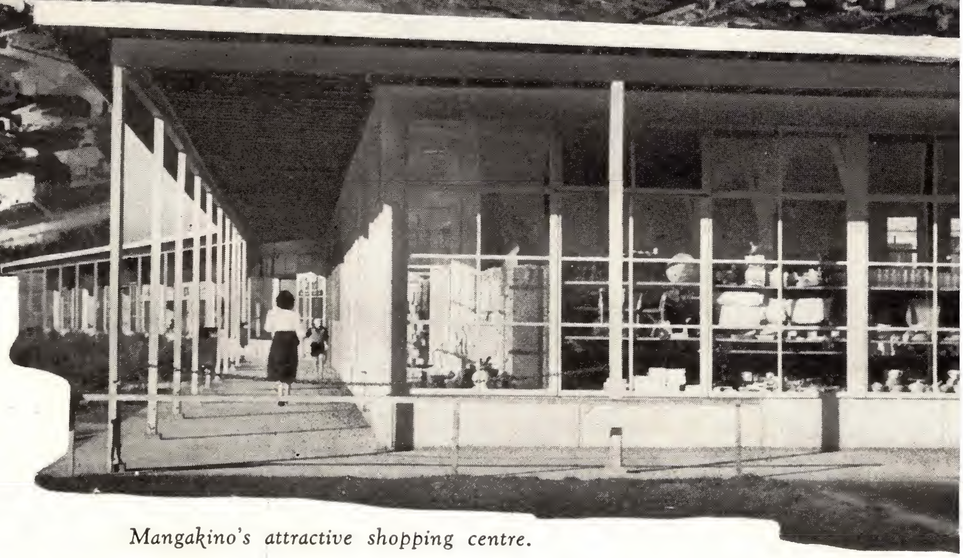
Another Huge Project

A SCHEME of similar capacity to Roxburgh is planned on the Waitaki River at Black Jack's Point. Benmore, as it is being called, will strengthen still further the South Island power supply.

The lake storage installations at Tekapo and Pukaki will be even more valuable when the Benmore scheme is operating.

From the potentially large sources of power available in the vicinity of beautiful Lakes Rotoroa and Roto-iti, in the Nelson province, a site for a relatively modest power scheme is now being investigated. This will develop about 30,000 kilowatts, to augment the supply from the Cobb scheme to the Nelson-Marlborough-West Coast area.

Most modern town in New Zealand — Mangakino will be populated by 4,500 workers and their families.

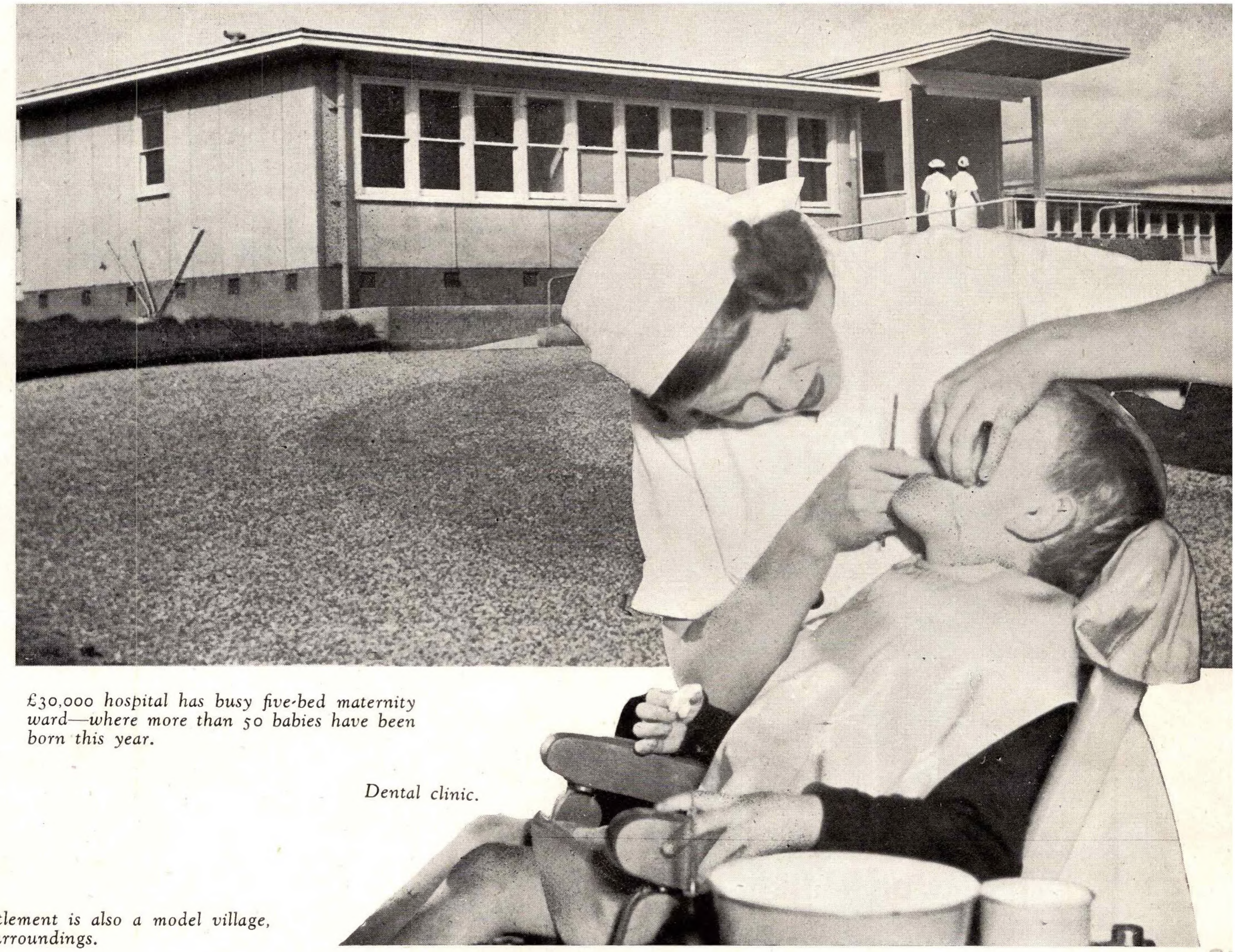


Mangakino's attractive shopping centre.

There's a picture theatre —as well as a school.

Workers' Town

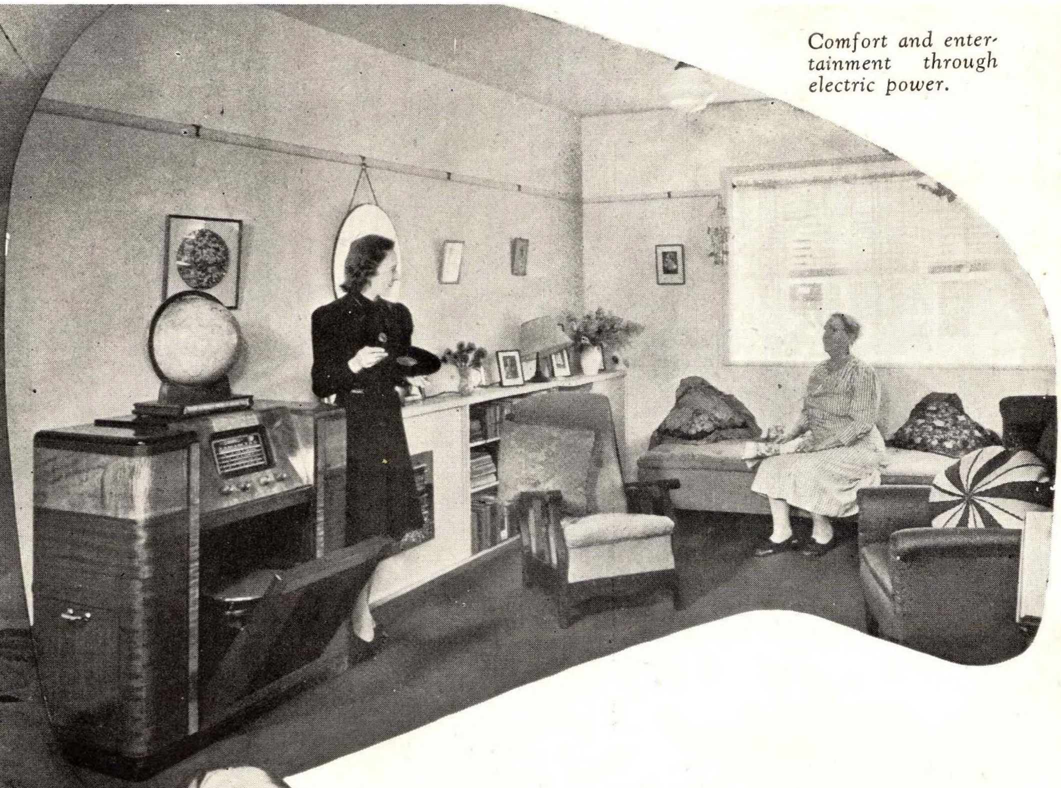
THE men who have the task of actually building our hydro-electric schemes no longer live in tented camps far from the comforts and amenities of civilisation. They have well laid-out townships with all reasonable conveniences and comforts, to which they can take their wives and families, with no qualms whatever about medical attention, schooling, entertainment facilities, religious upbringing and the other amenities of modern community life.



£30,000 hospital has busy five-bed maternity ward—where more than 50 babies have been born this year.

Dental clinic.

Arapuni's settlement is also a model village, in pleasant surroundings.

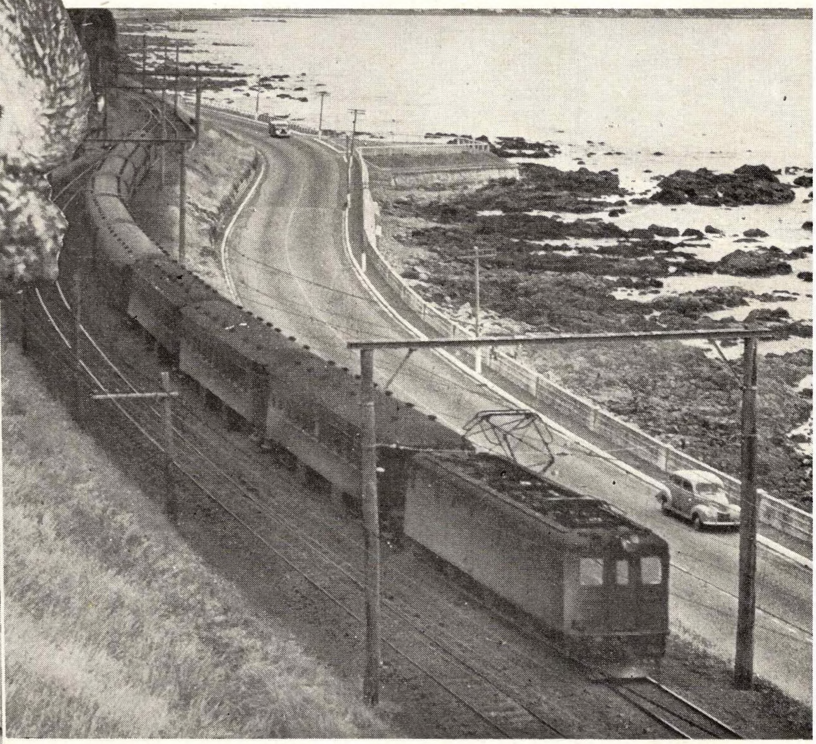


Comfort and entertainment through electric power.

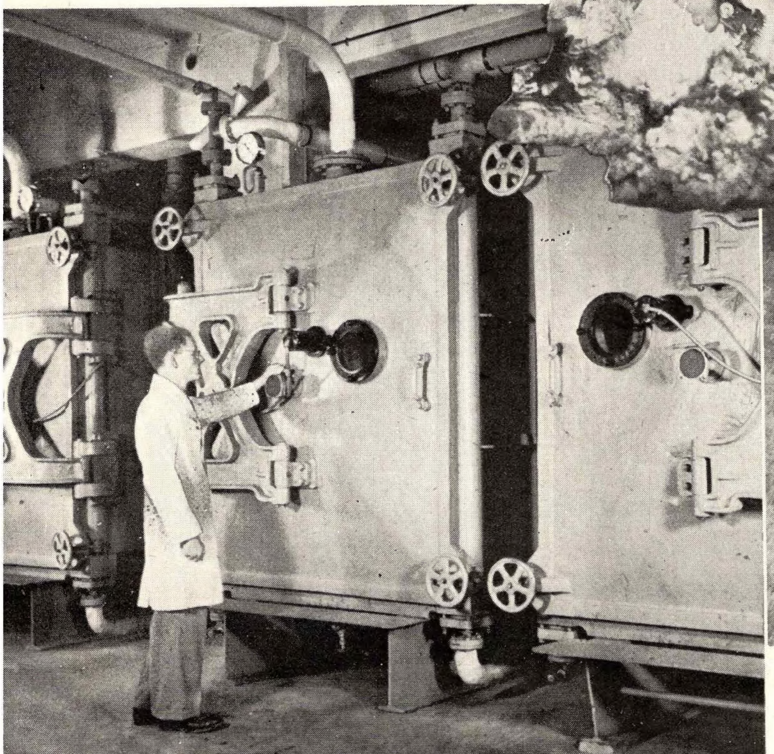
PRODUCTION and LEISURE

2YA's 700-ft. mast at Titahi Bay.

Shearing by electric power.



All main lines will be electrified.



Electric ovens.

Issued by the State Hydro-Electric Department of New Zealand, and printed by Hutcheson, Bowman & Stewart, Ltd., 15-19 Tory Street, Wellington,

Power for the People

THE aim of this booklet is to present a general picture of the work going on all over the country in the effort to catch up with the great and growing demand for electric power. It is the Government's duty to supply this power for the people to the full extent required. In spite of repeated setbacks we have all done our best—and by all I mean not only the Government and the State Hydro-Electric Department and the Ministry of Works, but also the workers on the job, the supply authorities who market the power, and the people themselves, who are making do in the meantime in the right spirit of unselfishness and co-operation.

I feel the country can be justly proud of its efforts which are already showing results in both the North and the South Islands. There is no doubt whatever that the days of ample power for the people will come as soon as humanly possible.

R. Semple

Spencer Digby photo.

Hon. R. Semple, Minister of Works, Minister of Railways, Minister in charge of State Hydro-Electric Department.

REPORT ON PROGRESS

HERE is a progress report, as at October, 1949, on the various hydro-electricity development schemes in New Zealand:

TRANSMISSION EXTENSIONS

A NINE-YEAR programme, costing £20,000,000, is under way for the construction of transmission lines and substations in both islands. About 2,000 miles will be added to the present 34,000 route miles of line.

Contracts have been let for the big substations at Otahuhu and Bunnythorpe, and the foundations are being prepared for the Haywards substation.

NORTH ISLAND

(Present State hydro capacity: 387,400 kilowatts)

Maraetai: The Waikato river has been diverted, the two coffer dams built, and the riverbed between has been de-watered. Excavations for the foundations of the dam are 30 to 40 feet down, and a start will be made on laying the concrete by the end of the year. Capacity: 180,000 kilowatts.

Whakamaru: Construction on this difficult job has been approved, and surveyors are laying out the site. The aim is to have no gap between the operation of the last generator at Maraetai and the first unit installed at Whakamaru. Capacity: 100,000 kilowatts.

Kaitawa: Work is going on to prevent seepage from Lake Waikaremoana. Great difficulties are being overcome, and there should be substantial results before the end of the year.

Total capacity in view: 667,400 kilowatts.

SOUTH ISLAND

(Present hydro capacity—including Waipori—180,160 kilowatts)

Roxburgh: Civil engineering work is proceeding at high speed, and already over a quarter-million cubic yards of spoil has been excavated from the diversion channel. Capacity: Initial, 160,000 kilowatts; ultimate, 320,000 kilowatts.

Cobb: Good progress is being made on the extensions to the Cobb scheme. The concrete intake and spillway should be finished in 1952. Additional capacity: 20,000 kilowatts.

Tekapo: The new station at Lake Tekapo should be ready by the end of 1950. The construction of lake control works will then be undertaken. Capacity: 25,000 kilowatts.

Pukaki: Lake control works here are so advanced that extra storage should be available for next winter.

Waipori: Work is under way on two new plants for this Dunedin City Council station, for completion in 1953. Additional capacity: 13,600 kilowatts.

Total capacity in view: 558,760 kilowatts.